SEP 20 1886
SMITHSONIAN INST.

THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLV.—No. 8. Whole No. 656. | NEW YORK, SATURDAY, OCTOBER 16, 1886. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
The Fourteenth Annual Meeting of the American Gas Light Association..... 227

EDITORIALS—
A Portion of the Programme for the Philadelphia Meeting..... 228
The Electricians' Plan of Canvassing..... 228
Adverse to the Cincinnati Electricians..... 228
Disallowed with Costs..... 229
*Large Otto Gas Engines in Use as Part of an Electric Light Plant at Prague, Austria..... 229
*Hydraulic Hoisting Carriage for Purifier Covers..... 229
Carbons for Incandescent Lighting..... 229
An Insurance Man's Views on Electric Lighting..... 231
The Coal Liming Process at the Folkestone Gas Works..... 232
The Alleged Vagaries of the Gas Meter..... 232
The Rate of Recession of Niagara Falls..... 233
*Notes on Mains and Services (by Harrison Veevers), with Discussion..... 234
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 238
Two Big Roofs in which the Gas Men had a Hand—Mr. Jos. Bate Goes to Muncie, Ind.—Something from Portsmouth, N. H.—Some Pittsburgh (Pa.) Gas News—Electric Companies Added to the List—Progress at Franklin, Ind.—Street Lighting at Buffalo, N. Y.—The Youth and His Little Match—Still Organizing—Cheaper Gas for Connersville, Ind.—Settlement of the Chattanooga Gas War—The Waltham (Mass.) Gas Company to Supply Electricity—Street Lighting at Toledo, Ohio.
The Market for Gas Securities 240

[OFFICIAL NOTICE.]

The Fourteenth Annual Meeting of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, October 9, 1886.

To the Members of the Association:—

As announced in my circular of September 14th, the Fourteenth Annual Meeting of our Association will be held in Philadelphia, Pa., October 20th, 21st, and 22d. The Convention will be called to order by the President, A. C. Wood, Esq., of Syracuse, N. Y., on Wednesday morning, October 20th, at 10 o'clock, in the *foyer* of the Academy of Music. The headquarters of the Association will be at the Hotel Lafayette, corner of Broad and Chestnut streets. I have made strenuous efforts to secure special railroad rates for the benefit of the members, but without success. I hoped I might be able to secure such rates as would represent a considerable saving to the Western members, but the Trunk Line Committee declined to make any concession.

I wish to urge upon each individual member that he will let nothing hinder him from attending our coming meeting. Most elaborate preparations have been made for the entertainment of the members and their ladies while in Philadelphia, so that everyone can be sure of having an enjoyable time. Moreover, as will be seen by the list of papers following, very many and important subjects are to come up for discussion, so that it is doubly incumbent on the members to turn out in full force at the meeting.

It is an admitted fact that the present season of the year is a busy time with many of the fraternity, yet it is also indisputable that when such arrangements have been made for the entertainment of the members, and so much trouble taken by others in the preparation of papers, it is incumbent on every member to show his appreciation of these kinds offices by his presence at the convention.

I, therefore, urge every member who can possibly leave his business to attend our Fourteenth Annual gathering; and I can assure such as wish to bring their ladies with them that the latter will not find the time hang heavily on their hands during their sojourn in Philadelphia.

I would ask such as have not answered my circular of the 14th ult., wherein I expressed the hope that each person whose name is on our roll-call would kindly inform me whether he would be present at the meeting, to be so good as to let me know, at as early a date as possible, whether they will be present, and if they desire hotel accommodations secured for them.

The following papers have been promised:

"A New Departure in Gasholder Houses," by Captain William Henry White, of New York.

"Gas Commissions," by George G. Ramsdell, of Vincennes, Ind.

"Three-Hour Charges," by A. B. Slater, of Providence, R. I.

"Condensation," by Robt. B. Taber, of New Bedford, Mass.

"Statistics Regarding the Gas Companies of America," by Wm. W. Goodwin, of Philadelphia, Pa.

"Suggestions upon Candle Power and Illumination," by A. E. Boardman, of Macon, Georgia.

"Some Further Remarks upon Natural Gas," by W. H. Denniston, of Pittsburgh, Pa.

"The Hydraulic Main," by Fred. W. Floyd, of New York City.

"Some Suggestions upon Paper Writing," by James H. Armington, of Brooklyn, N. Y.

We may also expect some remarks from Mr. Walton Clark, of New Orleans, La., on "Coal Liming."

I again urge upon the members that they think over the various subjects suggested by these papers, and come prepared to take active part in the discussion.

The Secretary's address, after the 16th inst., will be at the Hotel Lafayette, Philadelphia, Pa. Respectfully, C. J. R. Humphreys, Sec.

A PORTION OF THE PROGRAMME FOR THE PHILADELPHIA MEETING.

Secretary Humphreys having so thoroughly attended to the matter of placing before our readers, through the vehicle of the official notices from his pen, which have from time to time appeared in the columns of the Journal, a statement of the variety of the mental pabulum shortly to be served up to the members of the American Gas Light Association during the forthcoming Philadelphia sessions of that body, of course leaves nothing to be said by us in that respect now. But since all work and no play is apt to cause Jack to become a dull boy, we may pardonably and profitably take it upon ourselves to furnish a few facts which will go a long way towards proving that "insentient dullness," if we may be forgiven for employing the expression, will not have time or place to manifest itself during the Quaker City sessions of the gas men. In the first place, the Quaker City fairly teems with points of interest for the visitor; and although the "funny men" of other bustling centers in the States are inclined to twit the Philadelphian upon the "slowness" of his birthplace, we could never thoroughly appreciate the true inwardness of the basis upon which the charge was founded. "Slow" it may be; but sufficiently "fast" it certainly is for even those who are ever on the alert to hear the cry, "Another record broken." And as for magnitude; well, the "funny men" have but to compare it in that respect with anyone of their own abiding places.

Satisfied, then, with the vigor, vim and beauty of the chosen spot, our next consideration is to examine or scan the names of those delegated by the Association to take care of the visitors; we will therefore introduce them. First on the list, as chairman of the General Committee, appears the name of Mr. W. K. Park, whose sagacity, executive ability, and untiring qualities need no explanation at our hands. Mr. W.W. Goodwin next appears, as Chairman of the Committee of Arrangements; and since gold gathers no additional value when subjected to the process of gilding, we will not attempt that thankless and thriftless task. A host in himself, therefore fitted to be a host unto others. Mr. Jno. McIlhenny very properly, too, occupies the position of Chairman of the Committee on Finances—of course, we presume it to be understood that of these committees here given each is a sub-committee of the General Committee appointed a year ago—and that gentleman's name is a sufficient guarantee that his coadjutors have not been hampered by "a mean balance in the bank"—a very important matter, we hear it said. Mr. F. A. Dingee figures as Secretary and Treasurer of the General Committee; and fully understanding the innate modesty characteristic of that gentleman we will not say a word in his praise further than to predict the verdict, sure to be returned when all is said and over, in regard to his administration of the dual trust, of "Well done, thou good and faithful servant!" The gentlemen thus named have each in turn been assisted by Messrs. E. H. McCullough, Edward Stein, and Walter Wood, a trio of aides equal to any and every emergency. Then President Wood and Secretary Humphreys have had a hand in, too.

With that personnel to rely upon all doubt in regard to the enjoyment of the occasion must be dissipated; and now do we come to the point which we desire most earnestly to impress upon the delegates. From both technical and pleasurable standpoints the convention must be a grand success—if the members will only appear in force. That response is due to the gentlemen who have undertaken to present papers, for the presence of members will lead to interesting discussion on the topics treated of. Furthermore, it may be intimated that the local committeemen have made a special feature of the arrangements looking to the comfort and pleasure of those of the weaker sex who will grace the occasion by their presence; and it is hoped that the wives, daughters, aunts, and nieces of the gas men will be adequately represented. In short, the committeemen have made provision for the entertainment of at least 200 guests; and we sincerely hope they will be rewarded by the appearance of that number.

We may now briefly and in barest outline give the plan of the amusement programme. Commencing with the ladies, they will immediately after arrival be received by the Committee. During the business sessions the fair guests will have carriages placed at their absolute disposal to enable them to visit wherever and whatever each one or party may care to see in the Quaker City. Those who care to visit places of amusement will be supplied with the necessary admission tickets, etc. In fact the foregoing accommodation is to be in force during the three days of the meeting. The banquet will be held at 7:30 P.M. of Thursday, October 21st, in the magnificent rooms of the Union League Club; and we are assured that every preparation for it has been made on a grand scale. In fact it is beyond doubt that the decorations alone will furnish food for thought, while the club's *chef* will see to it that his *menu* will keep pace with the decorator's efforts. On the third day (Friday, Oct. 22) the guests will leave in carriages, at 9:30 A.M., to take a steamer at the Chestnut street wharf for an excursion on the Delaware river. A collation will be served on board, and it is expected that the water trip will take up two and one-half hours. On disembarking carriages will convey the guests to the Market street station works of the Gas Trust; and when that inspection is finished (but a short time is allotted for it) the carriages will once more be called upon to take the visitors on a tour through Fairmount Park—one of the handsomest municipal pleasure grounds in the country. A second collation will be discussed in the Park, upon arriving at the point where the Belmont Mansion is located. Those who have enjoyed a drive through Central Park, in this city, and then lunched at the restaurant which there answers to the Belmont Mansion in Fairmount, will appreciate the treat proposed by the committee; and those who have not had that delectable experience will appreciate it all the more. The day's pleasuring will then terminate; or rather the homeward drive will end at the hotel, which point will be reached in ample time to permit the guests to take the trains that depart in all directions at the hour of 5 P.M.

The committee hopes and expects that none of the guests will leave for home until early evening of the third day; and on our own account we once more urge that the representation be at least 200 strong.

THE ELECTRICIANS' PLAN OF CANVASSING.

Canvassers for any line of business favor ought by this time to be convinced that the best way to introduce their wares is to adhere strictly to the truth when expatiating upon the merits of the goods they seek to dispose of. One canvasser, now operating in the "electric line" in the State of New Jersey, in an attempt to convince the Jerseymen that the light of the future has been a "burning success" in the district of Morristown, appears to have slightly overstated the case, as the following letter proves:

Morristown Gas Light Company,
Morristown, N. J., Oct. 12, 1886.

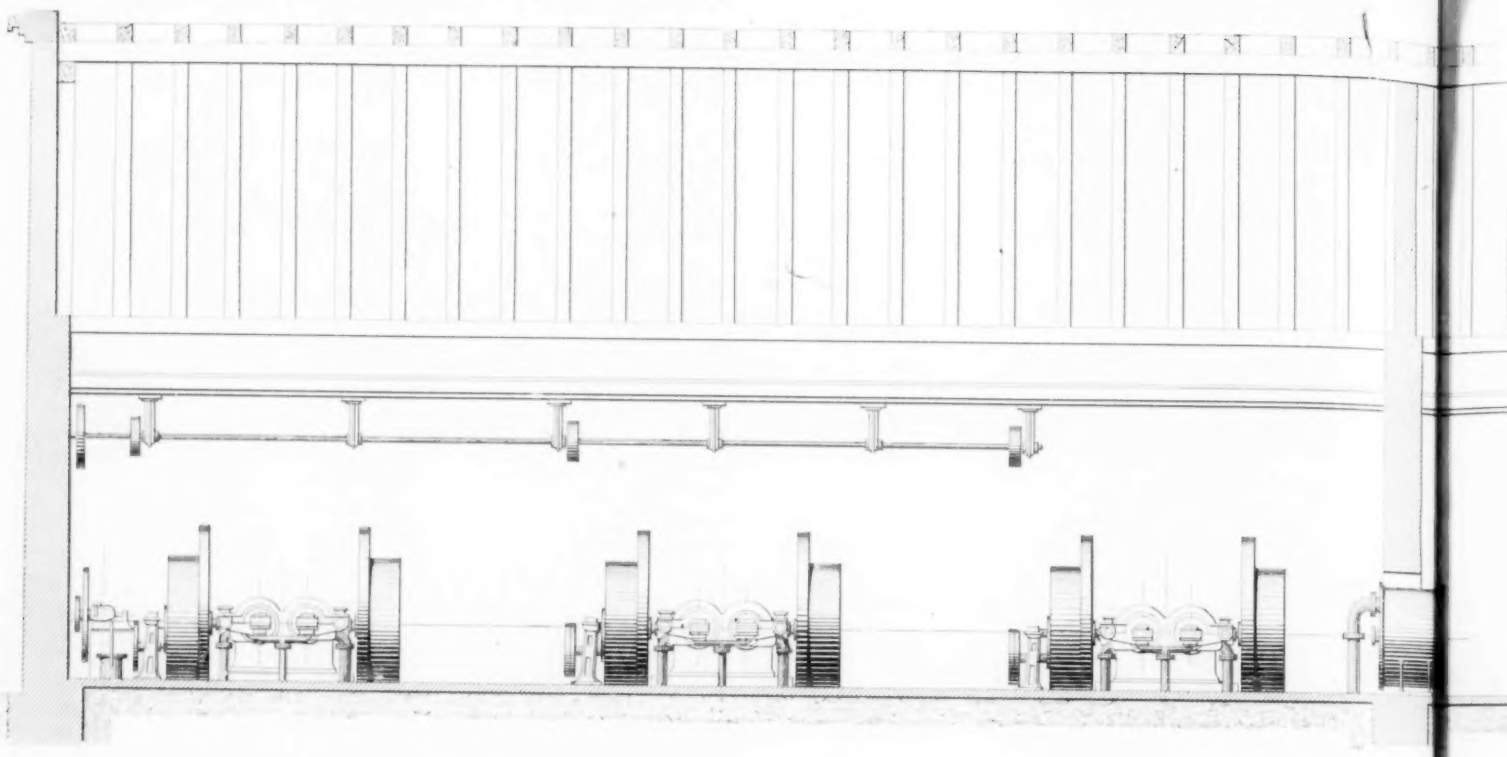
To the Editor American Gas Light Journal:

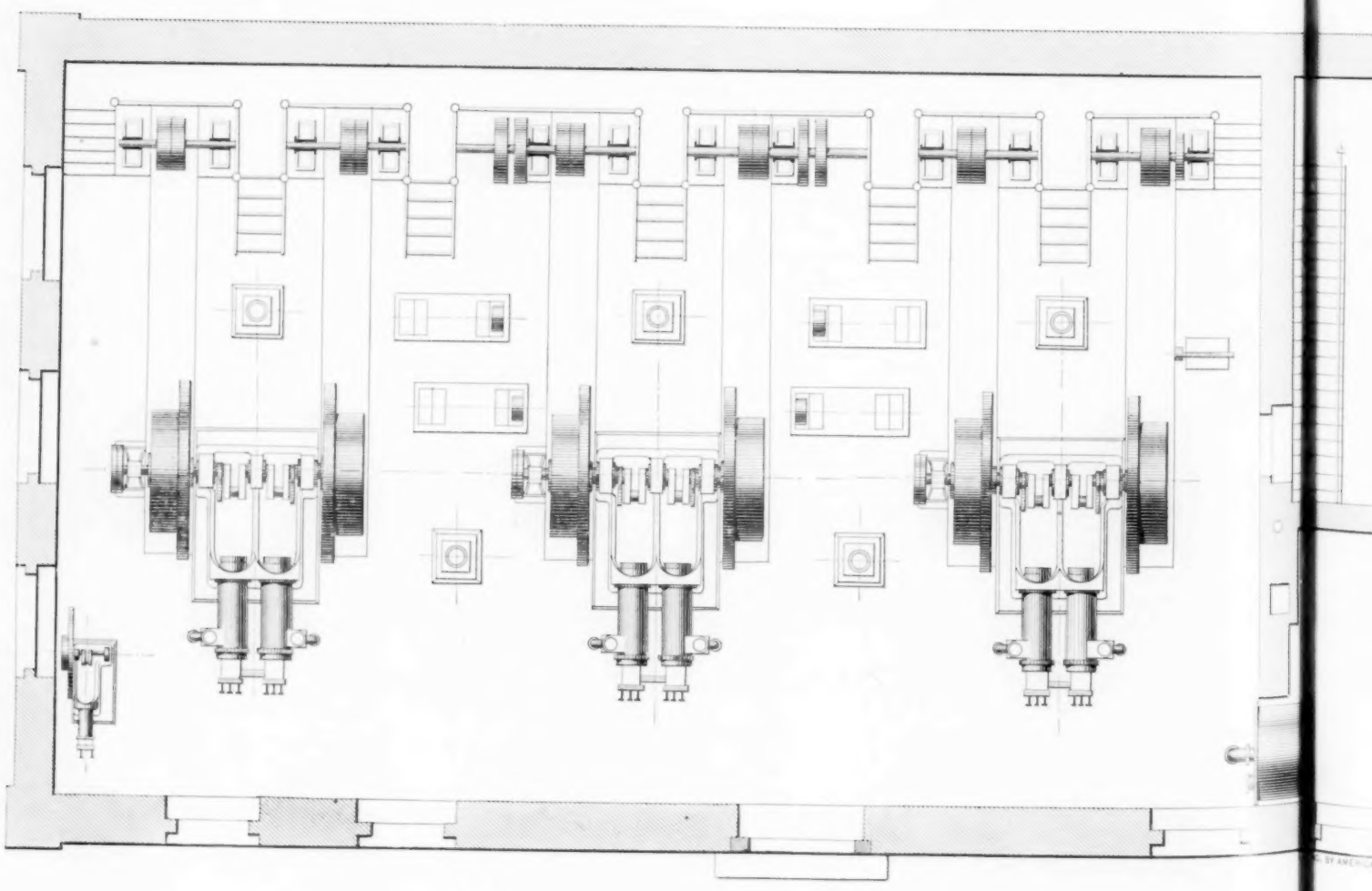
It appears that an agent for electric lighting is canvassing several towns in this State, and is claiming that he has obtained the contract for lighting our city. This is such a gross misstatement that I ask you to allow me, through the medium of the Journal, to state the facts to my brother engineers. For nearly three years endeavors have been made to form an electric light company here, and an agent, after repeated applications to our Council, backed up by the influence of the Recorder, at the August meeting of the Councilmen obtained permission "to erect poles on two of the streets and the public square, provided that the consent of the property owners be first obtained." No intention to adopt the light has ever been intimated by our City Fathers; and after considerable canvassing, with an offer to charge only 35 cents per lamp per night, only about 20 persons propose to try it experimentally for one month. I am pleased to state our business is flourishing. Since our last reduction (kindly noted in your columns) our consumption has increased over 100,000 cubic feet per month. We are also opening up a new district, which entails the placing of three-quarters of a mile of main pipe, and have several applications for gas along its line. Apologizing for the length of this communication, I am Very truly yours,

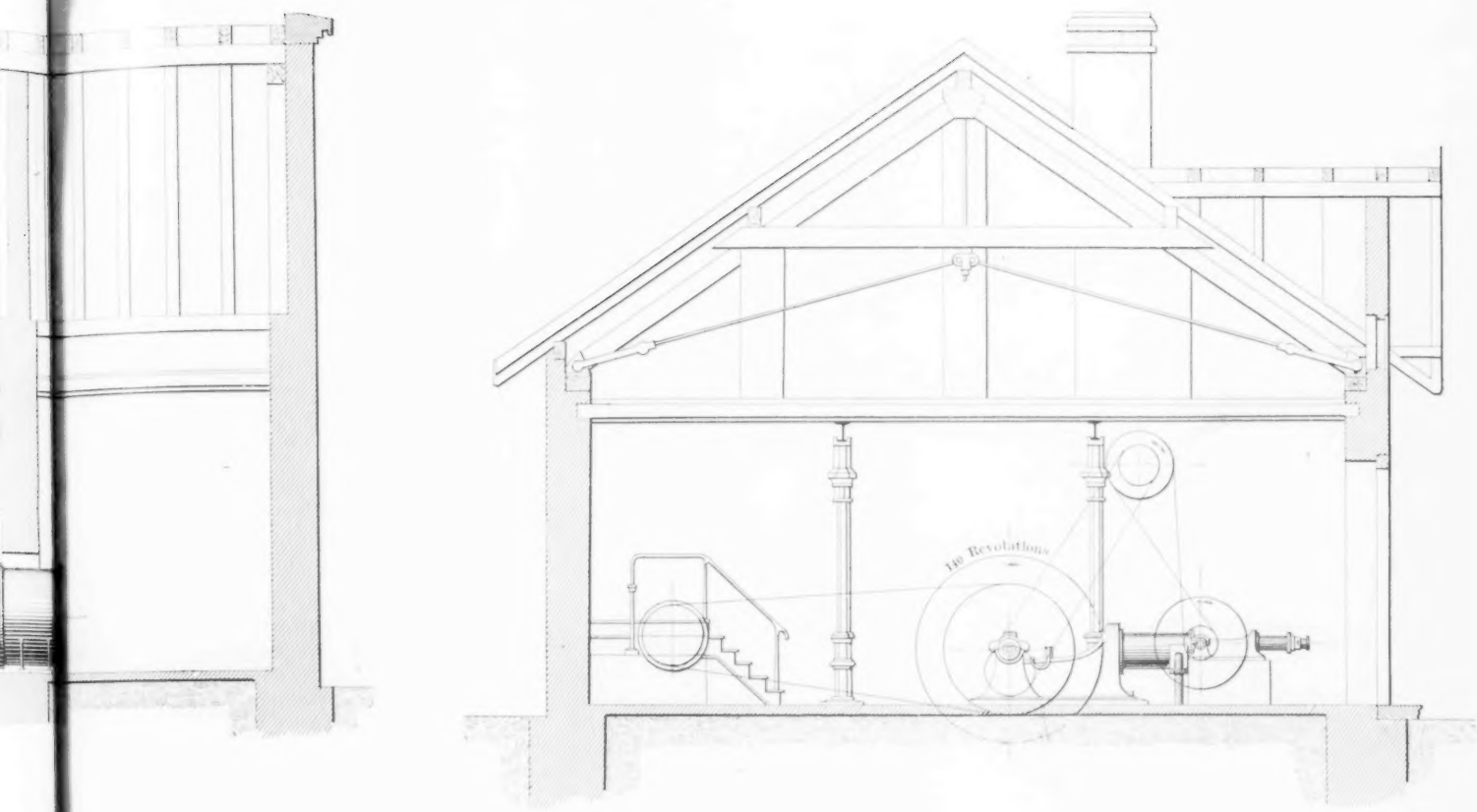
H. M. Hunt, Supt.

ADVERSE TO THE CINCINNATI ELECTRICIANS.

It is to be presumed that our readers have not forgotten the argument made by Gen. Andrew Hickenlooper when that gentleman appeared, on July 22d last, before the Committee on Light of the Municipal Council of Cincinnati, Ohio, and asked to be allowed to state his reasons against granting the Central Electric Light Company an exclusive privilege of lighting the Queen City for a term of ten years. We regret to say that we were unable to publish the reply of the Central Company's advocates to the General's scathing arraignment and exposure of their pretensions; but in any event the final outcome is similar to that which it was expected would be the case. On the evening of October 8 the sub-committee, consisting of Messrs. Varwig, Kammeron, Legner, Bird, McLean, Phiester, and Byington, after having discussed, ventilated, and dissected the subject for several months, finally determined to make an adverse report on the proposed ordinance. Shortly after that decission was reached the conclusions were referred to the joint committee (it consists of 20 members), 13 of the members of same being present. The joint body ratified the findings of the lesser body, and so rang down the curtain upon the remains of the Cincinnati Central Electric organization. Of the 13 members in attendance, 11 voted to reject—a clear majority of the joint committee even if the entire 20 voted on the matter—







ELECTRIC LIGHT PLANT

ERECTED FOR THE CITY OF PRAGUE, AUSTRIA.

Power furnished by three Otto Twin Engines of 50 actual horse-power each;
a One horse-power Engine being used for starting large Engines
by turning Fly-wheels.

OTTO GAS ENGINE WORKS,

SCHLEICHER, SCHUMM & CO., Thirty-third and Walnut Sts., Philadelphia.

Branch Office, 130 Washington St., Chicago.

SCALE: 1/8 Inch to One Foot.

OF AMERICAN BANK NOTE CO. N.Y.

and one of the two negative voices emanated from a Mr. Cherry, who is a member of the firm of Post & Co., manufacturers of electrical apparatus, and who therefore could not reasonably be expected to entertain an unbiased opinion. In commenting on the decision the Cincinnati *Enquirer* says: "The fact that the Central Electric Light Company, which never was incorporated under the laws of Ohio, admitted that they only wanted the franchise for the purpose of selling it, practically settled the question, notwithstanding the fact that the City Solicitor expressed the opinion that the city could not give the right to furnish light to the city exclusively to anyone." It may be possible that those who wish to prevail against the Cincinnati Gas Light Company in the future will exercise diligent inquiry in regard to the state of their armor, for would-be invaders, if they would but examine closely the wounds which caused the demise of their predecessors, cannot fail to be convinced that Gen. Hickenlooper knows how to wield a weapon with surprising dexterity.

Disallowed with Costs.

A letter from the managers of the Crystal Carbon Light Company, dated Philadelphia, Pa., Oct. 9, says that the injunction suit brought against them by the Albo-Carbon Light Company was on that date decided in favor of the defendant by Chief Justice Bradley, of the Supreme Court. The injunction was disallowed, with costs to plaintiff.

Large Otto Gas Engines in Use as Part of an Electric Light Plant at Prague, Austria.

Though the high prices charged for gas in this country—*i. e.*, high when compared with the rates which rule in European districts—have not favored the efforts of American builders of gas engines in their attempts to introduce here, as abroad, motors of large power, it is nevertheless true that room should exist for them where such high power is needed for the uses of the gas companies themselves. In these instances the value of the gas consumed in the generation of the power can be estimated at the cost of the gas placed in the holder.

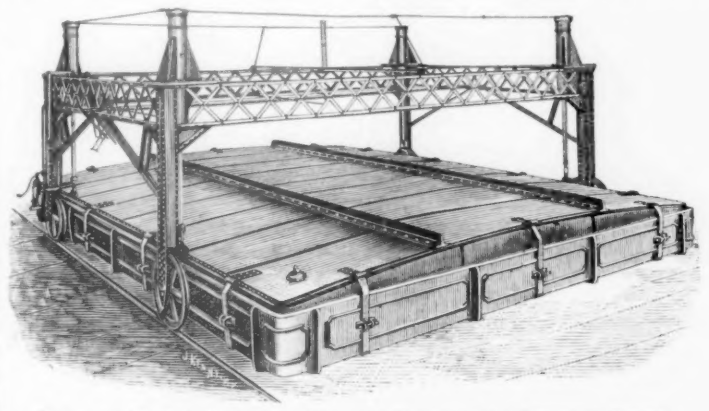
Gas companies, on the average, are not employers of high power, unless, of course, we except those whose managers have determined to carry on the supplying of another sort of illumination, and accordingly have added an electric annex to their already established gas plants. While we have never favored that policy or practice, it is a fact accomplished that many such dual enterprises are now in active operation in this country, and the system certainly appears to grow in favor rather than the reverse. The advocates of the plan assert that their pet theory enables the local gas supplier to retain control of the street lighting; but still we do not find many of them overanxious to assert that the said control is maintained at a profitable rate of remuneration. Not only is the retention of the public lighting urged as a reason for the adoption of the dual policy, but it is broadly claimed that the effect upon the public of the introduction of an electric plant and supply into a city or town is such as to educate the people up to a wish and desire for a gas illumination superior to the one which amply satisfied them prior to the advent of the 2,000-candle power apostle. We grant them the soundness of that reasoning in so far as it relates to the educational part of the claim; for it is beyond cavil that the greater the apparent success which has attended the operations of an electric lighting concern in any given city or town the greater has been the margin of increase shown by the subsequent sendout of the local gas suppliers. Still, if this be the case, is it not well to allow foreign talent to assume the role of educator, especially if the tutorship involves only a poor chance for profit, if, indeed, it does not mean a loss. But, in the present meager state of knowledge concerning the practical side of the topic, for the time at least, each one must be a law unto himself; and consequently it is our simple duty, as a narrator of current events, to call the attention of gas men who are electrically inclined to the fact that they have at their command a motor fitted to their needs which can be economically operated by their home product.

The gas managers in the smaller cities and towns are those most interested in this dual movement at the present time, as the larger districts have long since been thoroughly canvassed by the electricians. In connection with the interest manifested in this direction, as shown by numerous inquiries and voluminous correspondence received by Messrs. Schleicher, Schumm & Co., of Philadelphia, Pa., the builders in this country of the Otto engines, they have kindly sent us for publication drawings showing plans and sections of a portion of an electric light plant, consisting of three gas engines of 50 (actual) horse power, now in duty, as installed by the city of Prague (Austria) for the lighting of the Pfaueninsel. The drawings are reproduced in the shape of an illustrated supplement to this issue of the JOURNAL; and they cannot fail to be of interest, not only to the managers of small gas works, but to all those who are interested in the development of gas power as against power from steam.

Hydraulic Hoisting Carriage for Purifier Covers.

Any improvement which tends to save time and lessen the labor involved in the raising or hoisting of the covers to purifying boxes will no doubt be appreciated and welcomed by gas engineers and gas works superintendents; and particularly so in the case of large plants which necessarily require purifiers of large dimensions in order that the gas consumer may be assured of receiving a clean illuminating agent.

The accompanying illustration represents a new device for the rapid and easy lifting of purifier covers, known as the Nock and Floyd patent, which is



NOCK AND FLOYD'S HYDRAULIC HOISTING CARRIAGE FOR PURIFIER COVERS.

controlled, and is now being introduced to the notice of gas engineers, by Mr. Jas. R. Floyd, of the Oregon Iron Works, of this city.

In the view given a floor carriage is shown, the cut being reproduced from a photograph of one of the two hoisting carriages just completed by Mr. Floyd, at the new station of the Equitable Gas Light Company, foot of East 42d street, New York city. At the station there are four boxes, each 24 feet wide, 30 feet long, and 37 inches deep, with 24-inch cups. The cover is raised by the agency of four piston rods working in the hydraulic cylinders at each corner of the carriage. From the tank, which is secured to one of the lattice girders of the carriage, the water or other liquid is forced, by means of a one and one-half-inch compression pump, to a two and one-half-inch standpipe, fixed at the center of the carriage, and from there it is distributed, through one-half-inch tubes, to the lower sides of the piston head of each cylinder. The weight of the cover shown is 7,500 pounds; the lift accomplished is 3 feet 9 inches, and the time consumed or taken up in the operation is ten minutes.

As there are four points of support, to prevent straining the cover when moving it, while only three would be necessary to raise it perpendicularly, one of the pistons has a tendency to move faster than its fellows. For this reason four valves are provided to regulate the rise. The levers for these valves are close by the compression pump.

The space above the piston in each cylinder is kept filled with liquid in order to prevent the slow leakage from the under side of the piston, which is unavoidable in steam or hydraulic pressure. As the piston rises the liquid above it is carried off by means of the pipes tapped into the caps of the cylinders. The cover is lowered by its own weight, the liquid being discharged into the tank from whence it originally came. A commercial glycerine is used, in preference to water, on account of its low freezing point, the advantage of its greater specific gravity, and its value as a lubricator.

The carriage and raised cover are easily moved, the bearings being constructed out of brass and steel. One man can operate the machine; but two men will undoubtedly work to better advantage.

A hoisting carriage, on the plan described, was originally erected for the Equitable Company, in December, 1885, by Mr. Floyd, which worked on boxes of a dimension of 21 feet by 24 feet. So well did it answer the purpose intended that its success caused its application to the boxes spoken of above. It may be further noted that the Nock and Floyd hydraulic hoist can be applied to boxes otherwise equipped without any difficulty.

Carbons for Incandescent Lighting.

[A paper read by Mr. Arthur S. Hickley, at the Detroit Meeting of the National Electric Light Association.]

It is not my object in this paper to enter into a lengthy description of carbons of various makes, or to criticise what others are doing in that branch of electrical industry, but to offer a few remarks especially connected with the manufacture and testing of carbons, as far as I have been connected with the production of the same.

Incandescent lamps can be, and are, produced, which to a greater or les s

degree, fill the requirements of the light-loving community (that is, as far as small lights are concerned) so as to induce many to invest large sums of money in electrical incandescent plants.

Many invested largely at first on account of their novelty, others as an advertisement; but as the novelty wore off the consumer became interested as to the actual cost of running. In many cases they found their supply of lamps failed long before they expected, and they had to buy more, or allow dynamos, fixtures, and, in many cases, engine also to lie idle. Then the question arose: Which are the best lamps to use, and what constitutes a good lamp?

A long-lived lamp is not always an efficient one; you may have a lamp which lives 1,000 hours, but costs you too much to run. Better have one which lives only half that time, but which remains clear, or comparatively so to the end, and requires one-third the power to run it. Of course, the consumers want both qualities, longevity and efficiency.

With a view of meeting these requirements I commenced a series of experiments with carbon of every conceivable description of material and compound I could obtain; and although I recognized the fact that others, far more competent than myself, and with unlimited means, were working with the same object in view, I yet hoped a few crumbs might be left or overlooked which would fall to my share, and help towards the production of something better than was then upon the market.

It is not necessary to refer back to the many disappointments and failures of first experiences, for we have all been through that more or less. Suffice it to say, it soon became apparent that, as a general rule, an efficient carbon was not a long-lived one, and *vice versa*.

The question then arose: why is that so? And after many experiments, both in baking, preparing and treating, exhausting with and without gases within the globe, I gathered some facts which I have the honor of bringing before you to-day.

I soon discovered what is now a recognized fact, that after reaching a certain point of incandescence the candle power doubled up with the increase of a very few volts. A 16-c. p. carbon at 100 volts, made of a certain material, became 32-c. p. upon the potential at its terminals being increased to 120 volts; again, the E. M. F. falling to 95 volts reduced the candle power to 10. The size of the carbon had little to do with this in many cases. Thus a carbon of a certain size and 6 inches long took 8 ampères with an E. M. F. of 100 volts to produce a 16 c. p. light; another of the same diameter and length took 4 ampères and 100 volts to produce the same light. But let us watch them burn; at the end of 100 hours the 8 ampère lamp was becoming dark upon the inside, the 4 ampère one remaining as clear as when new; at 500 hours the 8 ampère lamp was so black that the carbon could be seen only when burning, and gave a light externally of but 6 candles. The 4 ampère lamp still remained clear, but burnt out at 550 hours, and had given not less than 15-c. p. until the end. Upon breaking the 8 ampère lamp the carbon was found to be roughened all over, the roughness being evidently caused by small particles of carbon being thrown off, these particles not only causing the carbon to increase in resistance by their separation from the main carbon, but carbonizing the interior of the globe as mentioned before.

Carbons of the same material but of different diameter were then tested, all, I may say, being carefully examined before and after the tests through a powerful microscope. Two carbons were tested, each one being 100 volts, but one being twice as thick as the other. The thicker one gave a 16-c. p. light with the consumption of energy equal to 70 watts. The thinner one gave 40-c. p. with the same power, but the latter soon burnt out, and upon microscopic examination it was found that the fibers were cracked all over, and were bent at right angles to the grain of the material and sticking out, as it were, towards the glass. I tried this upon a large scale, and made a carbon as large as a No. 13 wire. It behaved precisely the same, but now the fibers were quite visible to the naked eye, and stood out all over the filament as though it had become indignant at being abused and roughened, its coat resembling an electrified cat or a porcupine. With this carbon I could produce a light equal to a candle for every watt, with lamps of 50-c. p., but it would show fight and throw off its jacket. This was overcome at last in a manner I will explain later.

A carbon composed principally of the mushrooms formed between some arc lamp carbons, forced through a small hole under great pressure, threw off particles as soon as they were rendered sufficiently incandescent to be efficient. Structureless filaments behaved the same way, especially when not treated in a hydrocarbon.

Much depends upon the manner in which carbons are treated; a rapidly deposited carbon is very hard and more efficient than one deposited at a lower temperature, which is soft and mealy; but the hard deposit is in lumps, which appear under the microscope to be united only to the main carbon at their bases; a hard, almost flint-hard, carbon (for there is such) is longer lived than a soft one, but the latter is oftentimes the more efficient. I refer here to untreated ones.

The fact then appeared to me that the soft carbon (porcupine description) with a jacket forced upon it which it cannot throw off or ruffle, would be *the* carbon.

So, having decided the first or base, the question then arose, with what sort of jacket should it be covered? I was not entirely satisfied with the treating or improving in hydrocarbon alone, and having exhausted, as far as I knew, the vegetable fibers, I tried animal of all kinds except the Chinaman's hair, which, I learn, some one has actually patented; and I found that, size for size, the animal carbons were behind the vegetable in efficiency, but they could be used much smaller, considering that they were not so disposed to disintegrate.

Experiments then showed that a carbon which was exceedingly efficient but too soft, coated with a fine animal carbon, wonderfully lengthened its life and allowed of its being brought to a very high incandescence without destroying it.

The vegetable may be softened by an alkali and wrapped with an animal filament, and, after carbonizing, both are found to be united almost as one. In fact the vegetable has a coat upon its back which fits so tightly that it is compelled to keep its own on.

Again, in large carbons for 10 ampères a large amount of heat is produced, and if that heat could in some way be used before it left the carbon it would be beneficial.

It will be found that a large carbon built up of a number of small ones, intermixed with glass in a very finely spun state, and then wrapped, as described above, with any good animal carbon (of course this is done before carbonizing), will be very efficient, the carbon communicating sufficient heat to the finely divided particles of glass throughout its structure and rendering them conductors for the time being. A carbon of this construction appears to remain hot for a considerable time after the current is cut off.

Coating the vegetable fiber with another material, whether animal or vegetable, greatly increases the surface. If this carbon is heated to a high state of incandescence innumerable miniature semi-arcs appear to be formed all over its surface, wonderfully increasing its light-giving power.

Another important point to be considered is the preparation of the material before carbonizing. Many substances require little or none, but the greater portion must pass through a certain change first; some have a gelatinous or sappy substance contained therein, which if not removed or changed will cause miniature explosions within the material itself, and the fibers will be ruptured.

This must be most carefully avoided. A carbon which under the microscope appears to be a bundle of loose threads is of little value for incandescent lamps. You may treat or improve it if you like, and so cement the fibers together that, to all appearances, you have a good, hard carbon; but its backbone is weak, and an overcoat upon that, buttoned ever so tightly, provided it is made up of semi-detached particles (only cemented together at their bases and extremities, which is the case with a deposited carbon deposited in the usual way), will never make it long-lived. But it will be constantly increasing in resistance from the time it is put upon the circuit. If you have a fiber which, when baked, cakes or cements itself in a solid homogeneous mass, exhibiting no loose, hair like projections, then you need not trouble about subjecting that material to any process before carbonizing. On the other hand, as I have tried to show, a good material which cakes or cements itself to itself and to any substance upon which it is wound or braided, will sometimes save the weaker fibrous material upon which it was so wound.

In baking, also, it is of the utmost importance that that process be not carried too far, for you want the life of the carbon in the lamp not burnt out in the furnace. But at the same time you must bake enough. It is possible to bake so little that the filament when removed from the moulds, although to all appearance perfect, is virtually no conductor at all. Carry this a little further and it becomes a poor conductor, but is not sufficiently changed to be of any use, for as soon as the current is forced through it it bursts with a snap and a ring, like steel wire. After this stage the conductivity increases to a certain point, when it again decreases, this time on account of the carbon gradually wasting away, and you are, in fact, burning the very life out of it. The point is to catch it just when it is the best conductor, and before the unnecessary wasting away process commences. This can only be ascertained by repeated tests and great attention to the regularity of the heat. The heat should also be applied to the mould, crucible, or whatever form of receptacle you use to contain your fibers, as evenly as possible. The whole should be brought to a glow throughout, and at all parts at one time.

I have carbons which were baked so that their extremities, that is, where they are connected to the platinum, were overbaked and ruined, while the bow or upper part was scarcely done. Examining this carefully through a microscope, the ends were found to be weak and frayed out and useless, while the upper part or bow was solid, glossy, and appeared to consist of an entirely different material.

Again, some substances may be baked in bundles bound together, each one keeping its neighbor in place, while others would cement together in such a

manner as to render them useless. Do not bake too many in the same receptacle at one time, or so much gas will be given out that partial combustion will ensue unless you have some means of pumping out the occluded gas as fast as produced. Some substance, such as camphor, placed within the retort will sometimes enable you to bake successfully a material which otherwise would be useless.

I have burning, at the Russell House, lamps which contain a vegetable carbon, surrounded by an animal carbon. The vegetable alone in this case would be useless, but the animal covering preserves it and renders a high state of incandescence possible without disintegration.

In fact it can, without injury, be maintained at so high a state of incandescence as to produce a bluish tint which enables you to readily distinguish colors.

The efficiency of the carbon in this lamp is a little over one watt per candle power.

An Insurance Man's Views on Electric Lighting.

Mr. C. C. Haskins thus delivered himself at a recent meeting of the Northwest Association of Fire Underwriters, in regard to certain matters connected with electric lighting. He classified his subject under the headings of "Electric Lighting," "The Dynamo and the Currents," "The Wires, their Position, Insulation, and Contact," and "Safeguards," and spoke as follows:

The method of producing the current is virtually the same for both the arc and the incandescent system—the dynamo. This dynamo, or generator, sends a current out to line; it comes to an obstruction at a lamp; it jumps the obstruction, passes on to the next, and so successively at each lamp, and arrives home much the worse for wear. The dynamo is, however, constantly supplying a current, and the waste—or conversion, rather, for nothing in nature is ever wasted—is constantly made good.

Now, understand, this is the condition and performance of the current when the line is in proper order and form; that is, when the wire is perfectly insulated, separated by some one of those poor conductors—air, glass, porcelain, etc.—from contact with anything which leads to the ground or some other line. The wire must be of sufficient size to carry the current used without sensibly heating through the resistance it offers to the current. Every portion of the line must be of sufficient capacity. Where the wire enters the lamp, where the ends of the wire have been put together, at a joint, there must be full carrying capacity to prevent heating.

To enumerate the multitude of faults which may occur in a line to render it dangerous would require much more time than the Association would accord the subject.

The two wires which run from the dynamo are often quite near each other for some distance before they separate to go to line. These should not be less than 10 or 12 inches apart. The nearer they are together, of course, the greater the possibility of either getting these crossed or of getting them connected by some conductor. I have known a fireman to hang his wet shirt on two wires to dry—a trick which cost him a new shirt. The resistance of a wet cloth will develop heat as well as any other resistance. The wire in this case was insulated; but fire-proof insulation is not water-proof, and water-proof insulation is not fire-proof, except where the insulation is made so by covering with metal.

Gas men, plumbers, carpenters, and engineers, while not wilfully mischievous, often do great harm after a plant is established by running pipes, rods, or other fixtures for pumps, soda fountains, gas, sewerage, water, or steam, in close proximity to wires. They don't know any better, and they cannot be blamed, but must be watched.

A short time since I found one of these large wires within about half an inch of a gas pipe. Normally it was safe. The space between the wire and the pipe was an excellent place in which to place an iron chisel, screw-driver, or hammer. This would be quite natural. A wet towel would accomplish much the same result—create a ground connection, or what we technically call a ground.

Wires have sometimes been fastened to the plastered wall by iron staples. These may or may not be safe, temporarily, but it is not rare for the lathing in recent structures to be of wire, connected directly or indirectly with the ground.

Wires running through damp places—as cellars, basements, etc.—unless carefully guarded, are liable to form contact through dampness with water and gas pipes, either of which goes to ground.

Outside wires are full of expedients for getting a plant into trouble. Where they cross buildings, if there are other wires, either electrical or guy or stay wires, contact with these may mean a heavy loss in a block half a mile away. If the wire is a telegraph, telephone, police, or fire wire, its capacity for carrying is not equal to that of the electric light wire. If the current is deflected from its proper wire to the central office of the company whose wire is thus crossed, circumstances alone will determine what damage is to be paid for.

Some three years ago a small loss occurred which may serve to illustrate this phase of danger. A temporary line was run from a plant in the same block to furnish light for an evening entertainment. The wire was not insulated properly, and during the existence of this additional circuit a rain storm wetted the surface where the electric light wire rested, and formed a road for the current to a telephone wire. The telephone wire bore the indignity well enough until it reached the fine wire cable in the exchange. There it would withstand the insult no longer, and burst into fire. The wire was too small to carry the current thrust upon it, and diminished size, as we have seen, means increased resistance, and resistance means heat.

Ordinary water, then, may be made an element for producing fire. Why? Because it is a conductor of electricity, while wood, wool, silk, etc., are insulators when dry. Hence a wet wall, a damp board, even a dish-cloth, might, under favorable circumstances, cause a severe loss to an insurance company.

So, too, a wire on the face of a building is liable to come in contact with metal cornices, columns, posts, frames, etc., and I consider the long loops of wire which lead from the building to an outside lamp, which is suspended from a rope, particularly dangerous.

These hangings are hazardous to both persons and property. The pulley rope, by which the lamp is lowered and raised, being no essential part of the light proper, is never looked after, as a rule, until the weather has perhaps materially reduced its strength, or it has given way. Some half a dozen or so of these have fallen in Chicago through the neglect of this rope.

A still worse feature in this form of hanging is the almost constant certainty of grounds where these wires flap against rods, frames, etc., and are wrapped up in the awning, which latter may be wet at any time.

One ground on a line can do no possible harm; and if we can keep the first ground at a proper distance the second will take care of itself.

I have said that the current which any conductor will carry is proportioned to its capacity—the same as a water pipe; and if we have two conductors, one twice as large as the other, leading from the same source, one of these will carry twice as much as the other.

The current from the dynamo starts out on the line, and finds on its way a ground connection, say one-quarter of the way round. Three-quarters of the way round there is a similar ground. In this case a certain amount of current is cut off and goes to the earth at each of these points, and lamps in the farther half of the circuit are deprived of just so much current energy. The amount which will escape at these two points will be in proportion to the carrying capacity. If the grounds are good they will cut out the lamps beyond them entirely. If the line is a better conductor than the ground more current will traverse the wire than wastes at the leaks. If one of these happened to be a telephone wire a fire might be the result, and if one of them happened to be an underwriter a funeral might be in order. But if either of these occurred and there was no other ground on the line, there would be no work for either the adjuster or the coroner.

The incandescent circuit—and by circuit we mean the wires which carry a current—must also be kept free from contact with the earth.

The current used by the incandescent systems is less fierce than that used by the arc systems. We say of steam at 90 pounds that its pressure is greater than at 80 pounds. So of electricity, we have what may be understood as high and low pressure. The highest pressure we can create is shown in that which is generated by a frictional machine, and comes nearest to that of nature. The lowest pressure is that which we accumulate by means of batteries, such as are used in telegraphy. We have quantity also, which is but another name for a result of low resistance.

Now, the incandescent system uses a current of such low pressure that it is far more easily controlled and kept in the straight and narrow path than its wicked partner, the arc current. The wires, too, are differently placed. From either side of the dynamo the two currents are carried parallel out to the end of the circuit, say the upper floor of the building. They are not joined together at that point, but left open.

Now, from a given point on these, say the first floor, a wire is carried at right angles from each of the mains down the halls on that floor. Opposite each room we attach a wire to each of these secondary wires, and run them parallel to the end of the room.

In all this wiring we have made no connection between the ends of the wires; all these ends are open. Anywhere we like, governed by certain rules depending upon this matter of resistance again, we can put our lamps in, like rounds of a ladder. The branches leading into the room may be connected together by a dozen lamps, and the current has no way to get from one wire to the other except to go over these little bridges—these lamps.

There are modifications of this method, but they do not affect the question from our standpoint.

You will naturally ask what safeguard there is in a system so placed. I answer this: At every point where there is a branch wire—at the junction—is placed a safety-strip, which protects the wire from that point to the last

branch from the dynamo. The action of the safety-strip is this: Being placed in the direct path of the current, it carries all which crosses that part of the circuit. Its carrying capacity is less than that of the wire, for it is made of a metal of higher resistance, and it melts at a lower temperature. If a screw-driver or a nail, or any conductor, is made to connect the two wires leading to the two sides of the generator, the resistance is reduced at that point. More current crosses at that point than is useful; the soft metal melts and cuts the line in two. A leak from a water pipe may form such a contact, and, before the building would be endangered, the increased flow of current would open the line, put out the lights on that branch, and cut off the dangerous current.

The soft, or safety-strip, is graduated for the current it is intended to carry. Usually these are numbered for the number of lights they are designed to protect. The incandescent plant should not be allowed to run without safety-strips under any circumstances. It is the custom of some companies to put the safety-strip in the socket of the lamp. This is on the principle of fun for the boys but death for the frogs; the lamp may be saved in case of excess of current, but the building may burn.

It is all very well to place the safety-strip in the socket of the lamp, but the strip at the junction should not be omitted on any account.

Care should be taken to see that the wires do not run in such a manner or through such places as to allow of accumulations of dirt, lint, inflammable dust, etc. I once found, in part of an incandescent circuit, a large accumulation of material, just such as a rat would select for a nest, in contact with the wires; and in an arc light circuit, where the two wires had dropped behind a store sign, I found a colony of sparrows.

Were I asked point-blank what faults we should look for in a plant, I should hardly know what to answer, there are so many wrong ways of doing. These are so different, hardly occurring twice consecutively, that it is a matter of almost utter impossibility to answer such a question directly.

Two questions have been asked relative to the proper placing of a dynamo, which I will answer here. Outside the question of insulation, a dynamo may be looked upon as we look upon any other rapidly revolving machinery. It should be as thoroughly insulated as any portion of the line, and must be considered as part of the line. It should be placed on a foundation selected and arranged so as not to endanger the building by vibration. The fire hazard is not increased by the dynamo, when this is properly protected by insulation. It has been sometimes suggested that an electric light system served to fill the air—saturated it, so to speak—with electricity, and thus endangered the building. As long as a line is insulated properly, so long the current will remain on the wire. With a ground elsewhere on the line a leak might occur in a damp—very damp—room, through the moist air to ground; but with a well insulated line this could not occur. With dry air such a saturation would be impossible. Magnetism is always present in a room where a dynamo is, but this force is harmless to persons and insured property. It is, however, ruinous to good watches, the steel parts of which absorb and retain magnetism.

Some other questions, asking specific answers, have been propounded, which, without repeating, I will endeavor to elucidate.

Where a line is of the central plant variety—by which name we designate a plant running lights for rentals from sundry parties—the wire is often quite long, and consequently exposed to atmospheric electric changes, which might possibly overcharge the wire. It is hardly probable that any result would occur other than the destruction of the dynamo. For the protection of these machines it is well to put in what is termed a lightning arrester, which will carry off the excess of current in case of surcharging of the line from the atmosphere.

There have been many forms of arresters made, but none are thoroughly complete and reliable. The commonest form is made of three brass plates, with connections on the two outside ones, to the generator in one direction and to the line in the other. The middle plate is connected direct to ground. The saw teeth are, by an electrical law, more competent for discharging a current than a plane surface would be. The objections to this form are that a heavy discharge may create an arc which the normal current will afterward maintain, or the teeth may be welded to the ground plate by the discharge. These faults are easily remedied, however, by stopping the dynamo, and, as the arrester is in the room close to the dynamo, the trouble is manifested immediately and readily cured.

I have never heard of any injury to person or property from such causes, but the placing of such lightning-catchers effectually protects from possible discharges of lightning. The current generated by the dynamo will not leave the wire except through a ground. The current which is created in nature is on its travels either from earth to cloud, from cloud to earth, or from one cloud to another; so that with all the other routes open to it is hardly reasonable to expect it to single out a copper wire on its way to the heavens or into the ground.

As a matter of protection to the firemen, on such long circuits, it is not a bad idea to require placed at each building or block where the wires enter, a cut-off switch, which, being turned, completely cuts off the current from the locality or single structure; but even this, if wires are properly placed, is hardly necessary.

To my mind there is but one sovereign panacea which can cure the ills of the electric light business. No plant should be permitted to run until a thorough inspection has been made by a competent electrician, with power to enforce his suggestions.

In my opinion no wire for electrical purposes should be allowed above ground. While these are permitted to swing in the air, from poles and housetops, contact with other wires is almost certain, and where these are telephone, telegraph, or other grounded lines, the result, if one such is crossed by an electric light wire, might be disastrous. With these in the ground the wind and weather can have no effect, and such a thing as a cross would be next to an impossibility.

The Coal Liming Process at the Folkestone Gas Works.

We are indebted to Mr. R. P. Spice, London, England, for an enclosure containing the following extract from the Directors' report to the stockholders of the Folkestone Gas Company, made at a general meeting, 10th September, 1886:

"The objectional results attending the frequent changing of purifiers on these works, and the extreme difficulty in securing (except at a considerable cost) a suitable site on which to deposit the foul lime under the old system of purification, have occasioned your directors considerable thought and anxiety for some time past. It is, therefore, with much satisfaction they are now able to report that by the adoption of 'Cooper's Coal Liming Process,' which has been in operation here for nearly four months, the source of their anxiety has been removed, the whole of the gas made since the 17th of May last (31,000,000 cu. ft.) having been most effectively purified without change of purifier or removal of spent purifying material.

"Cooper's coal liming process has been in operation at the works of the Tunbridge Wells Gas Company for a period of two years and eight months, and so perfect has been its working there that during the whole of that time not a single change of purifier has been found necessary.

"Although from a financial point of view it is not contemplated that any great benefit will be derived by the company, the advantage of a system which insures the perfect purification of gas with a degree of certainty hitherto unknown would alone justify its adoption; but when it is further considered that in addition all grounds of complaint by reason of the noxious odors arising from the foul lime, in its removal from the purifiers, or from its place of deposit, have now been completely removed, the change should be hailed alike by shareholders and consumers with the greatest satisfaction."

The Alleged Vagaries of the Gas Meter.

The *Gas Engineer*, in commenting on this subject, says that although the gas meter, whether "wet" or "dry," as a means of measurement of the fluid for which it is intended, is far more accurate than the ordinary means adopted in everyday life in the measurement of liquids, it is subjected to a degree of suspicion and abuse which are alike unjustifiable and undeserved; and, as an example of this, within the past few years the proverb has been introduced into the States, "He lies like a gas meter."

This, of course, arises from the ignorance of the public concerning the construction and action of the instrument in question, as well as the heavy gas bills which at times are presented, often under circumstances similar to those hereafter related; or through the carelessness or ignorance of the consumers or their servants, and for which gas stoves afford a good opportunity. Heavy gas bills are occasioned by various circumstances, such as the pressure at which the gas is consumed, the description of burner and glasses employed, the care observed in dispensing with the gas when no longer required, and the thoughtlessness of consumers concerning the unceasing vigilance of the meter.

First, as regards the pressure. As a rule gas companies are compelled, either by nature or the various levels of the districts supplied, or the size of their mains, or other causes, to give excessive pressure in some parts of their district in order to insure a good supply at the lowest or remote parts of it. The effect of excessive pressure is to reduce, and, indeed, in some cases to destroy entirely, the illuminating power of the gas; which effect is considerably advanced by the use of imperfect burners and glasses.

To illustrate, let us take a good argand burner capable of consuming 5 feet per hour, with a pressure of one-tenth, when the light evolved will be equal to 16 candles. But with the same burner and glass, and the holes being reduced to that degree so as to require a pressure of thirty-tenths to supply 5 feet per hour, then, on burning the gas, no light whatever is evolved from it, it being simply a blue flame. Or if we suppose a good argand burner having a much larger chimney than is necessary, then a current of air cools the

flame and diminishes the luminosity of the gas in a remarkable manner; and, indeed, with a chimney two feet long the gas yields no available light.

Again, by reducing the consumption of an argand burner from 5 feet to 2½ feet, instead of getting the light of 8 candles, as we would imagine, we get but four candles, and as a consequence in our endeavor to economize we actually lose one-half of the available light to be derived from the gas; and if we further reduce the flame the loss of light is still greater.

With flat-flamed burners this variation is not so great, which gives them a degree of superiority over the argand on this account; but against this the loss by excessive consumption, which readily shows itself in the argand by the amount of smoke formed, is not appreciable in the flat-flame burner except under extraordinary circumstances. However, with very heavy pressure these burners give only a low degree of light accompanied by a roaring noise. Therefore we may say that great pressure is one of the many causes of heavy gas bills and the often alleged vagaries of the meter; and this should be controlled by suitable means which are accessible to all consumers.

As regards the burners, it is well known that some of these, although intended for the consumption of a certain quantity of gas, give only two-thirds of the light yielded by well made burners. With flat-flame burners, the smaller sizes, consuming say 2 or 3 feet per hour, give considerably less light in proportion to the gas consumed than larger kinds consuming 5 or 6 feet per hour; hence one cause of heavy gas bills for the light obtained arises from the use of burners consuming small quantities. It follows, therefore, that it is more economical to employ two burners, each consuming 5 feet, than to have four burners of 3 feet per hour.

To avoid heavy gas bills only the most ordinary care is required to control the pressure to the premises by a regulator, and to shut off the gas when no longer desired, particularly in gas stoves. Servants, as a rule, are generally very negligent in this respect, and for this reason they require proper surveillance; but once the necessity of economy is understood by them, little difficulty is afterward experienced. From the preceding we learn that if a consumer burns gas under a heavy pressure or with imperfect burners, or if he does not exercise ordinary care in its use, then heavy gas bills will be the result, and which he may be disposed to treat as the vagaries of the gas meter.

There are, however, various other circumstances, of which we give a few examples, which appear at first sight mysterious in the highest degree—such as a meter fixed with all the burners turned off, when it still continues persistently to indicate that gas is passing. On one occasion a mechanical engineer of our acquaintance insisted that his meter indicated although no gas was passing; but he forgot the fact that if this could be accomplished then perpetual motion would soon follow, when the days of steam and gas engines would be numbered.

Within our knowledge, many years ago a gentleman well known in the gas world, having commenced business, was anxious to economize in every possible manner; and as his consumption of gas exceeded considerably what he estimated it ought to be, he resolved to test his meter during the night. To his surprise the following morning, although all the lights were turned off, he found that 300 feet had passed the meter and were indicated by it. The experiment was repeated two or three times with the same result, and without the slightest odor of gas on the premises. Puzzled beyond description, and assured that, if the meter indicated, the gas must have passed, he examined the whole of the fittings, and outside the attic window he found a pipe which conveyed the gas to a room below, cut as with a chisel, and from this aperture the gas had escaped for months. Of course, the escape being outside the house it was not detected by the odor, and this would probably have continued for years if it had not been for the position of the gentleman; and if the cause had not been discovered it would have been numbered among the vagaries of gas meters.

In another instance enormously heavy gas bills were presented quarterly to a gentleman in a town in the North of England, to which he protested as utterly impossible, and refused to pay. Here again the meter indicated incessantly night and day. All the pipes throughout the house were then examined—the flooring being taken up for the purpose—but no signs of escape or odor, and still the meter went on. The engineer of the company was then referred to to solve the difficulty; and as he knew it could only arise from an escape, and the loss was considerable, he had every foot of gas pipe that was embedded in the walls uncovered, when at last, to the surprise of all, immediately over the mantelpiece and at the back of the looking glass when in position, a small pipe was found carried direct into the chimney, where the gas escaped without giving any odor. This had been done by some malevolent workman, and but for the discovery would have been considered a vagary of the meter.

But it is not only from escapes that these incidents arise, for, many years ago, on an inspector going to take the index of a meter at an establishment, on stating the quantity consumed the owner protested that no gas had been burnt, that it was a fraud, and that he would not pay. The following quarter the same inspector went for the same purpose, when he was asked blandly the question "How much have I burned this quarter?" "None," was the reply. "None," said the proprietor, "then I have more faith in your meter than in the word of my servant; for I took away the key of the main, and only replaced it when I knew you were here." The servant had been in the habit of burning the gas in the absence of the master, but denied it.

Another case occurred some time ago in the United States. A gentleman and his family occupied a "flat" similar to those in Scotland, and now coming into use at the West End of London. They shut up their house and left to visit some friends in a distant part of the country, and at the end of six months they returned. A few days afterward the gas company sent in a heavy account—indeed, for a much larger quantity of gas than would have been consumed had they remained in their home. The gentleman, believing it to be an error, went to the gas office and showed the receipt for gas consumed up to the day of his departure, when he was informed that the account was for gas consumed since them. "But," said he, we have been away all the time, and the house has been shut up; consequently no gas could possibly have been required." This was met by the reply that the meter indicated that the gas had been consumed, and he must pay. This certainly appeared a vagary of the meter to which no explanation could be given or reason assigned. The gentleman, much exasperated at the apparent extortion of the gas company, went home and informed his wife of the circumstance, when she, after a little hesitation, said: "Well, now I remember; how very silly of me; but just as I was on the point of leaving I returned for something I had forgotten, and lighted the gas to get it and omitted to turn it off again; I found it alight on our return—and so we must pay the account." The gas had been constantly alight during the six months, and was of course indicated by the meter.

Circumstances similar to this occur frequently, although perhaps for shorter periods, and at times they are put down as vagaries of the meter.

An instance came under the writer's notice only a short time ago, where there was an unaccountable loss of gas without any clue to the point where it escaped. In this case the former tenant of the house had a small pipe and tap placed at the back of the range and completely out of sight, and probably the sweep, on cleansing the chimney for the new tenants, accidentally turned on the tap and so left it; consequently the gas escaped up the chimney without giving any indication of the loss by its odor. Until the cause was discovered undoubtedly the tenant held but a poor opinion of the justice of the gas meter.

There is still another source from which the loss of gas may most mysteriously occur—namely, by rats gnawing and perforating the lead or other soft metal pipes and allowing the gas to escape. Instances of this, with drawings of the perforations, are given in Dr. Bowditch's "Analyses of Gas." But recently, in the district of the Crystal Palace Gas Company, an incident of this kind occurred. In a building was a cast iron column, which was encased with boarding, and on this was a gas bracket. Within this boarding was an escape of gas, to discover which one of the boards was removed, when the lead pipe to supply the bracket was found perforated by rats, the marks of their teeth being clearly defined. This fact clearly shows the importance of avoiding all soft metal pipes in inclosed localities accessible to rats, as from their destruction of the pipes serious explosions might occur.

Finally, we may say that the meter is among the most reliable of mechanical apparatus in existence; and whether the full quantity for which it is made is supplied, or the smallest blue flame, both are recorded by it with unerring accuracy, until in the course of time it is worn out. Hence the so-called vagaries of meters, if only carefully sought for, as we have shown, are easily discovered; and in all cases they arise through the carelessness of the consumers or the gasfitters.

It is now upward of 44 years since Mr. J. O. N. Rutter introduced his pamphlet on "The Advantages of Gas," in which he gave considerable information to consumers, and popularized the use of gas. At the present day, with the greatly extended uses of gas and the ignorance that pervades among the community at large on the subject, a similar work is highly desirable, which would remove many of the absurd ideas of the vagaries of the meters, and establish a degree of confidence in the gas consumer concerning this instrument which at present does not exist.

The Rate of Recession of Niagara Falls.—At the Buffalo (N. Y.) meeting of the American Association for the Advancement of Science, Prof. R. S. Woodward, of Washington, D. C., contributed a most interesting paper on the "Rate of Recession of Niagara Falls." The Professor, in the course of his remarks, said that the area of the rock worn away at the Horseshoe Falls, between the years 1842 and 1875, was 18,500 square feet, equal to 0.425 acres; between 1875 and 1886, 60,000 square feet, or 1.37 acres. The main length of the contour of the falls is 2,300 feet. The Professor, however, not wanting to be classed in the list of alarmists, says that the time required to witness a recession of one mile, if the rate be placed at 2.4 feet per year (which he thinks to be a fair estimate), is just 2,200 years.

Notes on Mains and Services.

[A paper read by Mr. Harrison Veevers at a meeting of the Manchester District Institution of Gas Engineers. The discussion on same, which was deferred to a subsequent session of the Association, is also appended. Our report is taken from the London *Journal*.]

Of the many branches of our profession as gas engineers, the one relating to the mains and services which deliver the gas to the consumers is not the least important. On their character depends a satisfactory supply, and (of not less consequence) the amount of "unaccounted-for gas." The subject has not, I believe, as yet been discussed by the members of this Institution; and I therefore purpose in this brief paper to introduce a few points which

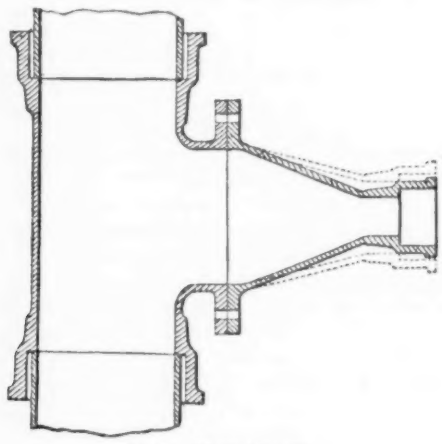


Fig. 1.—Main Branch

have occurred in my experience, in the hope that, in the consequent discussion, the practice of the members may be compared and a mutuality of benefit be the result.

Mains.

I do not intend to discuss the proper sizes and strength of mains for particular work, nor the plan of jointing, as these subjects are so ably treated in all treatises on gas engineering that it would be a waste of time to reproduce them here. I need hardly say that in Vol. II of "King's Treatise on Coal Gas," and in Mr. Newbigging's "Handbook," these are fully described. Suffice it to say that in deciding on the size of a main not only should the present needs of a district be considered, but also the future probable requirements of that and of the district beyond.

In supplying a street I recommend that, as a rule, a main be laid under the footpath at each side of the street. This may seem a serious expense, and so it is as a first outlay; but when it is considered that by so doing the

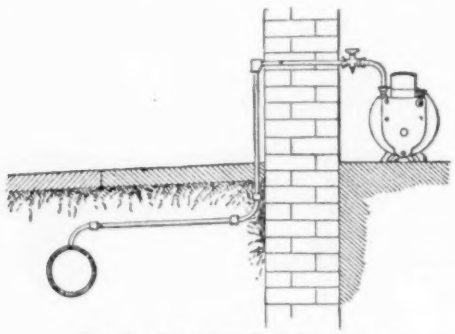


Fig. 2.—Wrought Iron Service.

service pipes are shorter and the roadways are not injured, the matter assumes a different aspect. Roadways are now made so much more substantial han formerly—with concrete foundations, and with sets bound by asphalt —that they should not be disturbed. If all mains were laid under the footpath the use of the steam roller would not be the danger to gas authorities that it is now; and there can be no question of the utility of this means of consolidating the superstructure of a roadway. That, by thus doubling the length of mains in a district, there may be a double leakage I do not admit. Experience has taught me that escapes are not so much due to the defects in the main pipes as in the services, and at their junction with the main. By having the main under the footpath, and consequently near the premises to be supplied with gas, a short service only is required; and as a good fall can be given there is less risk of water lodging in it. (See drawing No. 3.) A long service pipe, with a low gradient, is liable to cause jumping lights, particularly where the ground has subsided through sewering or other work. With a short service, too, there is less loss of pressure. As a rule I lay a small main (never less, however, than a 3-inch one) under the footpath on one side of the street for the local requirements, and on the other side a larger one, also for local requirements and for the district beyond. Should an increased demand arise, the smaller main would be taken up and a larger one substituted.

This removal of a main leads to the principal subject of this section of the paper—the connection of a branch with a trunk main. The plan I adopt has at least the merit of simplicity. We all know the annoyance of having to break a trunk main, or of breaking the joint of a socket, when a new or enlarged branch main is required. My practice for many years has been to have all branches on the main of the same diameter as the main itself. Each branch has a flange (as shown by the drawing No. 1), to which is fixed a diminishing-piece with flange and socket. In the drawing the 12-inch pipe has a 12-inch branch, to which is connected a short pipe diminishing to 3 inches.

When laying a trunk main I leave a branch opposite each footpath of

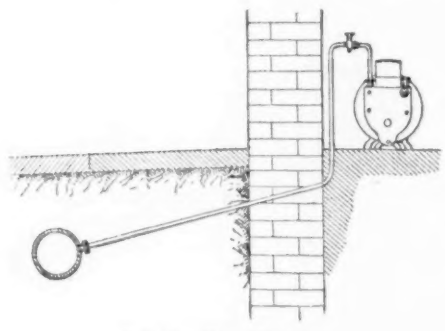


Fig. 3.—Lead Service.

every actual or intended street. Should there be no present necessity for a side main, a blank flange is fitted to the flange of the branch pipe. Supposing we are laying a 12-inch trunk main, and only a 3-inch side main is necessary, then a 12-inch to 3-inch diminishing-piece is employed. In future, should this main require to be relaid with a larger one (say a 6-inch), then the 3 inch diminishing piece is unbolted from the flange of the branch and a 12-inch by 6-inch substituted. This can be done economically and quickly, and without disturbing the trunk main. The T and diminishing pipes are made as short as possible, to avoid expense; and the T-piece should always be made with a socket at each end, and, when the main pipes are turned and bored, the socket should be large enough to take the spigot end of the pipe with room for lead. The reason for the pipes being double socketed is that the branch has to be exactly in one place; and the ordinary socket might not "hit" that place. The socket joint of the diminishing-pipe is run with

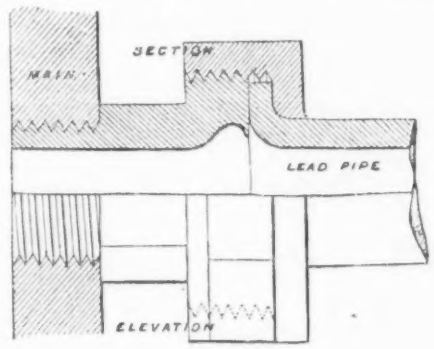


Fig. 4.—Service Union.

lead, so that, when it is removed and the lead melted from it, the pipe will be good for future use. To insure uniformity in the dimensions of flanges, it is well to take the sizes of one valve maker, so that, on changing a branch, the order can be given without a preliminary measurement of the existing flange. I may remark that the smallest main in use—preferably a 3-inch pipe—need not have a flange cast on the branch, a socket only being required.

It is not advisable to have the interior of pipes coated, as the action of the gas tends to soften or melt the material used for that purpose; and cases have occurred where the syphon boxes have been rendered temporarily useless and mains have been choked. There is no better preservative of iron than the constant presence of gas. The only advantage in having the interior coated is that a smoothness is given to the surface, and friction is consequently diminished; but this advantage is counterbalanced by the objection mentioned.

The specification given in Vol. II. of "King's Treatise on Coal Gas," pp. 339-40, is, I consider, too long and elaborate. I find the following is sufficient for all ordinary purposes:

SPECIFICATION OF CAST IRON PIPES

Required by.....

Every pipe to be made of good grey iron, strong and close grained, to be truly cylindrical, and of equal thickness of metal. Any pipe which may be one-third thicker in one part than in the corresponding one will be rejected. The pipes are to be free from sand or air holes, or other blemish; nor is any hole or blemish to be filled up with any substance whatever. Each end of every pipe to be cast with a fair face, to fit the pads of the testing machine. Each pipe will be proved on its receipt at the works, with water having a pressure of 80 lbs. to each square inch, and will be repeatedly struck with a 2-lb. hammer whilst subjected to that pressure. Any pipe allowing the water, whilst so tested, too ooze, sweat, or burst out, will be rejected.

Each pipe, when well cleaned from sand or core, and delivered to the ....., to be of the specified weight; and any pipe varying above or below that weight more than 1 lb. for each inch of internal diameter will be rejected.

The gas engineer shall have power to reject every pipe delivered under this contract which he shall declare to be in any respect faulty; and all rejected pipes must be removed from the.....works at the expense of the contractor.

The pipes to have turned and bored spigot and faucet joints of dimensions approved by the said gas engineer; and the initials of the makers of the pipes must be cast on the sockets.

The pipes must be cast vertically; and the contractor must state when he will be able to commence delivering the pipes, after the acceptance of the tender, and when he will complete the order.

Every condition relative to pipes shall apply to bends and branches, which are to be tendered for at per cwt.

The pipes to be delivered free at.....

The.....retain until the.....day of....., 18 , the liberty of accepting the tender for the whole or any of the sizes specified, and do not bind themselves to accept the lowest or any tender.

Tenders, indorsed "Pipes," to be sent to me before.....

.....Gas Engineer.

Gas Works....., 18 .

Pipes Referred to in the Foregoing Specification.

Internal Diameter.	Length of Each, Exclusive of Socket.	Weight of Pipe.	Quantity Required in Yards.

Services.

What I have to say with regard to services is of greater importance, however, than what has been said of mains; and it will no doubt lead to a greater diversity of opinion. I believe, as previously stated, that we have a greater amount of leakage due to defective service pipes than to defects in mains—either through corrosion of the metal or defective coupling to the main. Almost invariably, when a report is made of an escape, the cause has been in connection with a service pipe. I have brought samples of tubes recently disinterred; and they represent the state of most services when taken up. The remedy for this is the complete abolition of the use of wrought iron underground and the substitution of lead. At the first glance this would appear to be an extravagant change; but when it is considered that the labor of laying a wrought iron service is more expensive than laying a leaden one—the former requiring the tube to be cut and rescrewed and many joints fitted—the difference diminishes; and when to this is added the future value of the metal, the economical advantage in cost alone is in favor of lead. Let us see how the relative cost will compare from actual experience. I will take the length of such service pipes as are indicated on drawings Nos. 2 and 3.

Cost of ½-inch Wrought Iron Service.

6 feet of wrought iron tube at 4½d. (gross)	25½d.
2 bends at 8d. (gross)	16
1 elbow	8
Or, with discount	12½d. net.
Labor of 2 men for 5 hours	62½
Total cost	75d.

Cost of ½-inch Lead Service.

6 feet of lead tube—2½ lbs. to the yard—5 lbs., at 1½d.	7½d.
1 service union (brass)	10
	17½d.
Labor of 2 men for 3 hours	37½
Total cost	55d.

The actual first cost, therefore, of the two services is 1s. 8d. in favor of lead. But it is very wisely advised that "wrought iron pipes of smaller internal diameter than ¾ inch should never be put in the ground"—a doctrine I heartily support; but, owing to the smoothness of the interior of lead tubing, I consider the ½-inch lead pipe is equal to a ¾-inch wrought iron one, on account of the difference in friction. The cost of a ¾-inch wrought iron service is as follows:

6 feet of ¾-inch wrought iron tubing at 6d. (gross)	36d.
2 bends at 11d. (gross)	22
1 elbow at 10d.	10
Or, with discount	17d. net.
Labor, as in the ½-inch wrought iron service	62½
Total cost	79½d.

The cost of the ½-inch lead service being 4s. 7d., or a difference in favor of lead of 2s. per service—that is, the cost of the ¾-inch wrought iron service will be nearly 50 per cent. more than that of a ½-inch lead one.

As steam and galvanized tubing, which some engineers prefer, cost 50 per cent. more than plain gas tubing, their claims to rival lead are out of the question. The value of the old metal when taken up has been referred to, and it is not an item to be neglected in the consideration of the relative values of the two tubes. The actual value of the old lead is 3s. per cwt. less than the first cost of the pipe; and at present prices the value of an old lead service is 75 per cent. of the first cost of the metal. The value of old wrought iron service pipes is *nil*. Let me repeat that lead pipes, being smooth inside, offer less friction to the passage of the gas than wrought iron. By the use of a ½-inch lead tube a smaller main cock is required, giving another advantage in cost over wrought iron of 8d. The weights of lead tube per yard for services are as follows: ½-inch piping weighs 2½ lbs., and is made in lengths of 45 yards; ¾-inch weighs 4 lbs., in lengths of 30 yards; and 1-inch weighs 8 lbs., and is in lengths of 25 yards.

An objection is sometimes raised to the use of lead services that they are liable to sink and so give a lodgment for water, with the consequent annoyance to the consumer of jumping lights. But when the main is laid under the footpath, and, consequently, near the premises to be supplied, so good a fall can be given to the tube that there need be no fear of this fault occurring. If a long length be required with a low gradient, the pipe can be supported by a strip of wood; or, if the consumption is likely to warrant it, a 2-inch cast iron pipe may be laid as a service; but these are exceptional cases. The coupling of the service to the main is very simple, as shown on drawing No. 4. The lead itself, opened out bell-shaped, is compressed in the union, and makes a perfect gas-tight joint, as metal-lead* always does.

In my sketch I have given an example, too often followed, of having part of the wrought iron service exposed (see drawing No. 2); and there are several objections to this plan. As a matter of taste, it is unsightly. In frosty weather the supply of gas is often stopped by the choking of the pipe by the congealed moisture. In a previous paper I stated that 30,000 feet of gas carry a gallon of water as vapor; and this vapor, and some of the heavy hydrocarbons—our best friends for illuminating purposes—become condensed and frozen in the interior of the pipe. Too often the poor meter is thought to be in fault, and receives more than its share of hot water and blame. These outside services also require pointing or tarring occasionally, thus causing an additional expense.

One point in favor of a lead service I must not omit, and that is the fewness of the joints—or, in other words, places liable to escapes—compared with a wrought iron one. In the former there are between the main and the meter three joints; and in the latter there are ten. It is due to this difference in the number of joints that the labor of laying lead is cheaper than wrought iron.

I might lengthen the paper and shorten your patience by referring to such exceptional matters as providing for subsidence due to colliery or other underground operations, and to the many ingenious ways of making joints; but these have been exhaustively dealt with by papers contributed to the Gas Institute, and in the various works treating on gas engineering. There are before you samples of service unions, and drawings illustrating the main branch (No. 1), the wrought iron (No. 2) and lead services (No. 3), and the service union (No. 4).

*I call it "metal-lead" to distinguish it from red and white lead, which too often form a deceptive joint. There appears to be a solvent action by gas on the oil with which red and white lead are compounded, and the result is leakage of gas. For manhole lids of gasholders, and other similar operations, the metal is superior to its colored namesakes.

Discussion.

Mr. I. Carr (Widnes) said he considered that this was a very bad time to commence a discussion upon a debatable subject. After having spent such an enjoyable day, and got into such a pleasant humor, it was very difficult indeed to feel in an antagonistic mood. At the outset he should like to say that with Mr. Veevers' remarks on main laying he almost entirely agreed. He thought the suggestion of having a separate main under each footway in a street was a very good one, and had many advantages over the plan of laying a single main down the roadway. Mr. Veevers in his paper alluded to one of the disadvantages of the latter method—viz., that the main might be fractured by a steam roller or heavy vehicle passing over it. This appeared to him (Mr. Carr) to be rather an important matter. Many of them had mains in roadways which they could not take out; and they constantly read of the litigation going on between the various Vestries and the gas companies in the metropolis. It occurred to him that in the suggestion of Mr. Veevers might be the cure for all this. Nearly every main in Widnes was under the roadways; and they had a steam roller there, but not a single case of fracture had taken place. He believed the cause of mains being broken in this way was to be found in the weight of the roller. The one at Widnes weighed 10 tons; and he was told that it did its work as economically and as well as a heavier one would. His advice, therefore, to gas managers who were threatened with the advent of one of these machines was that they should try to get the authorities to purchase a light one. It should not exceed 10 tons; and if it was as heavy as 15 tons there would certainly be trouble. Coming now to Mr. Veevers' remarks on services, he must say at once that he did not, for several reasons, agree with him. He found, in the first place that Mr. Veevers made an estimate of the comparative cost of wrought iron and lead services which was a most unfair one. In the paper there was an illustration (fig. 2) of a long iron service, which was, in his opinion, based on an unsound idea. It might have been carried out in some few places in the past; but he did not suppose that anybody put such an idea into practice now. There was an opening and two joints at the connection of the service pipe with the main, which was more than was necessary, though, of course, the expense of it all was included in the estimate of the cost of the wrought iron service. If they referred to fig. 3 they would find quite a different connection. Mr. Veevers spoke of the way of carrying the service outside the building; but he (Mr. Carr) believed he was perfectly right in saying that no one carried a service outside a building except for some special convenience, and it would not be possible with lead piping. Well, when Mr. Veevers sketched his idea of laying a lead service, he did not connect it at the top of the main and take a turn half way round it; but he went to the nearest point, as he (Mr. Carr) presumed anyone would do in laying an iron service. There were further objections to lead services which he need not touch upon; for he had no doubt that other gentlemen would take them up.

Mr. W. W. Hutchinson (Barnsley) said it appeared to him that lead services had one or two advantages. Mr. Veevers in his paper pointed out the main one, which was that the capital sunk in lead services was, to a great extent, recoverable. He told them that about 75 per cent. of the first cost could be obtained for the old lead services; and this was a very different thing to what occurred in the matter of wrought iron services, which were not worth taking out of the ground. There was also the advantage of less joints in the lead than the iron service. But the disadvantages seemed to him, in his own particular case, to outweigh the advantages. To give effect to the leaden service system it appeared to him that they would require to extend the plan of laying the mains under both footways. If this were done it would do away with some of the disadvantages. For instance, if they simply replaced their services of iron by lead, they would need wooden supports in the case of long lengths; but there would be the disadvantage of the pipes being occasionally crushed by steam rollers, such as the one used by the Corporation of Barnsley. Then there was the trouble of water settleing in lead services; and the danger of breakage when other pipes were being searched for. Fraudulent connections were also very much facilitated when lead service pipes were used. Another point was how to make a ready distinction between water and gas pipes. Water services were, of course, always of lead; and how would they distinguish between a gas and a water pipe? There was also the question of the settlement of the ground caused by sewerage operations, which was a source of much trouble, especially when the openings were improperly filled in.

Mr. Thomas Newbigging (Manchester) also agreed with the plan followed by Mr. Veevers, of laying a main under the footpath on each side of the street, provided the thoroughfare was a wide one—say, over 12 or 14 yards wide—and especially when the carriageway was laid in concrete, and the setts bound by asphalt, and also where the road traffic was heavy. But they must not, he said, be led to give their adhesion to this proposal without due consideration. Discrimination should always be exercised; and in the ordinary streets of a town, which were by far in the majority, and in the smaller towns and country districts, where the traffic was comparatively light, he could not recommend the adoption of the practice of invariably, or even generally, laying two mains. The additional heavy cost of the two mains, if universally adopted, would be enormous, and would not, in his opinion, be compensated for by the reduced cost obtained by shortening the service pipes, nor in the lower leakage. There was one point that was worth calling attention to in connection with this subject, and this was, where the footpath was a narrow one, a main laid under it was apt to be placed dangerously near to the foundation of the buildings; and in case of a fracture, or a drawn joint, causing leakage, the gas was liable to find its way through the somewhat rough and open foundation work of which many dwelling houses and other structures were composed, and thus there was considerable danger of explosion. He thought it an excellent plan to have all the branches on a line of mains of the same diameter as the main itself, and made in the way described by Mr. Veevers, with a flanged outlet. Indeed, there did not appear to him to be any objection to it whatever, but everything to recommend it. On the question of avoiding coating the inside of mains, he also concurred with the author of the paper. It was superfluous expense to begin with; and was, for the reasons given, a positive evil besides. In the matter of services—especially of short services—Mr. Veevers made out a good case in favor of lead; but where the service was a lengthy one (and the majority were such—larger at least than was shown by Mr. Veevers), he preferred the iron pipe, and especially if laid in a trough, and embedded in a mixture of tar and asphalt. A lead pipe was liable to be crushed and flattened, and its bore consequently diminished, in passing through the wall of a building, and in the subsequent blocking of the hole, unless the greatest care was exercised. It would also be seen from Mr. Veevers' illustration (fig 3) that if the leaden service pipe was to be conveyed through the wall of the building in the manner shown, a much larger opening would be required than with an iron pipe. In one case three bricks in depth would have to be taken out; while in the other one brick would suffice. Mr. Veevers had omitted to take these facts into account in estimating the cost. It seemed a perfectly easy and simple matter on paper; but when one came to place the service pipe in the way indicated, the difficulty was considerable, and workmen did not always take the trouble to do exactly as a manager could wish. It should not be overlooked, too, that in some soils, lead piping was more subject to oxidation than iron. He had known in his experience lead pipes eaten through from the outside within the brief period of six months. Here, again, in the matter of the class of service pipes, discrimination was needed; and it was not wise to be bound to a hard-and-fast rule. He could not help remarking on the greatly diminished leakage or unaccounted-for gas in these days, as compared with what it was 15 to 25 years back. This pleasant state of things was due to various causes; but the principal factor which had tended to reduced leakage was, he believed, the greater attention and vigilance that was now exercised by gas managers in the laying and jointing of mains and service pipes. He considered, with other speakers, that they were much indebted to Mr. Veevers for introducing this important subject in the paper he had read to them. Matters of this kind could not be too frequently discussed; and although they might not always have much to say that was strikingly original, yet in a discussion by practical men—as they all were—new ideas were often evolved and suggested, the knowledge of old facts that had lapsed from their minds was revived, whilst the most elementary hints were useful to many members, especially young ones, so that the result was good and beneficial all around.

Mr. W. Miles (Clitheroe) was sorry he did not hear Mr. Veevers read his paper, and had not seen much of it before that evening; but it struck him very forcibly from the experience he had had that it was very desirable that two mains should be laid in every town. In Clitheroe they had had many broken pipes, owing to the use of the steam roller. [Mr. I. Carr: What is the weight?] It weighed 15 tons; and not only mains, but also service pipes laid across the streets had been broken. He had, further, found a great many service pipes across the street moved upwards and downwards, which allowed water to enter, and caused the gas to "jump." In all cases where the mains were laid under the footpaths or near the channels, they had no trouble with "jumping" gas. With respect to the decay of service pipes, he found, from his own experience, that this did not take place in certain soils. In the neighborhood of Lowmoor, a village supplied from the Clitheroe works, they could not get a pipe to last more than five or six years. It did not lose gas until the earth was disturbed; but when it was they heard frequent complaints of the escape of gas, and on being bared the pipe was found to be full of holes. In this case it did not matter whether the pipes were of lead or iron; while in the borough of Clitheroe pipes laid for the same period were as good as new. There were pipes which he put down some 20 years ago, or close upon it; and they looked almost as good now as when laid. He was, as he might say, very much surprised to read some of the accounts of the small quantity of unaccounted-for gas in different places. He read the other day of one gas works where the loss was only 1¼ per cent. How they could manage this was a mystery to him. He had been in the habit for several years of having the dry meters in the district periodically

examined (say, every three years); and he found that some which had been working from three to five years were losing 10 to 15 per cent.

Mr. Newbigging—Are they not wet meters?

Mr. Miles said he referred only to dry meters; and how any manager who was using them could show so small an amount of leakage as in some of the cases he had alluded to puzzled him, and he really could not understand it. As Mr. Newbigging had observed, it was very desirable that these things should be periodically discussed. It behooved every gas manager to be up and doing. They all knew that they had two very formidable opponents to deal with. In Clitheroe they had, he should think, not more than one-third of the population consumers of gas—the remainder burnt oil; and this, notwithstanding that the gas works belonged to the Corporation, and therefore to the ratepayers. They could not, however, educate the inhabitants to this fact, and as a consequence they had to suffer.

Mr. C. Elliott (Leyland) looked upon Mr. Veevers' paper as a very practical one; and the discussion upon it had resolved itself, in his opinion, into a question of experience. His experience had long since convinced him of the advantage of iron services; and he could not help thinking that if the members looked at the illustrations given in the paper, they would come to the conclusion that the iron service was the neatest job. Certainly, in his opinion, it contained the neatest workmanship. The advantage of iron services over lead ones was, he thought, considerable in several ways. In the first place, they had a rigidity in the former which conveyed the condensation; while the latter were apt to sag and sink, and required bolstering up, which caused a great amount of trouble. Then, as Mr. Newbigging had pointed out, to carry a lead service through a wall involved more labor, and in the end made a very poor job. Another objection was that with lead services the leakage was apt to be continued along the pipe into the building, which led to greater danger of explosions; and there was the further point that damage might be done to the service pipe by carelessness in turning off the gas at the meter tap.

Mr. T. Moore (Macclesfield) considered it impossible to overestimate the importance of good sound and efficient distributing plant. He had had a good deal of experience of both lead and iron services; the former being used in a district where iron could not live. He found that the cost of lead service pipes was slightly in excess of iron ones. A great deal had been said about the details of the illustrations to the paper; but he took it that these were simply meant to show the main points of the argument, and that Mr. Veevers did not bind himself to strictly abide by them. Still, an additional joint or two might be used with advantage when the ground was new; and as a rule he should himself prefer to drill a main at the top rather than at the side. He found in practice that in some cases lead services became perforated from the outside; and this took place not only in the ground, but sometimes in the walls too. He did not know whether this was due to the bricks or the mortar; but it was a fact that in some instances the lead did not last long. He knew a case now in which the whole of the nature of the lead had been taken out at the point where it passed through a particular wall. There was a matter which had not been mentioned in the discussion of the paper, though it was one of importance in connection with mains and services; and it was that they should have good workmen and good tools. In traveling about he often saw men engaged in laying both gas and water services who hardly seemed fit for the work. When they remembered the trouble of drilling a cast iron main under difficult circumstances, it seemed to him that they should entrust it to a skilled man rather than to one who was little better than a laborer. A main and service layer should be a good mechanic, and be furnished with proper materials and tools; and his work should be considered of a high class, and not of a secondary nature which almost anyone could do. He thought it very important to a gas manager that his workmen outside should be thoroughly competent—able to drill a straight hole, put a good thread in, and make an efficient job throughout.

Mr. T. Duxbury (Darwen) said that in his town the Corporation had a 16-ton steam roller, which had caused him a good deal of trouble, and done a lot of damage to the mains and services. He was greatly opposed to its being purchased; and in the first year of its use, his leakage jumped up 6 per cent.—from 9 per cent. to 15 per cent. His practice was to carry a 4-inch or 6-inch main along one side of the street, and a 2-inch subsidiary main along the other; so that it was only at the crossings, or in the principal streets, where there were large mains, that they had them in the roadway. They used all lead services, and, except in some few instances where the ground had been filled up with refuse or engine ashes from the paper mills, they lasted exceedingly well. In a few cases where the refuse from the mills had been tipped they found that neither wrought iron nor lead services would last. They put a 1-inch slab under each service; but it was only a short distance in most cases from the main to the houses. The services were laid on the principle which Mr. Veevers suggested in his paper. They did not find much difficulty in distinguishing between the water and the gas service pipes, which usually entered the houses at different points; the water service being at the end of a row of houses, and that for the gas at the front near the door, or underneath the window of each house. He was very much obliged to Mr. Veevers for bringing this subject forward; because the paper was calculated to make them all think of the importance of looking after their service pipes.

Mr. Moore wished to add that he never used common gas tubing for unmeasured gas. The piping was all specially made for the services, and was tested. He paid a little more for it, but he was sure this was wiser than using inferior tubing for services.

The President remarked that one or two points had been omitted in the very excellent discussion they had had. Steam rollers had been mentioned, but not the equally great nuisance caused by traction engines, which did an immense amount of damage to gas and water pipes and mains, to drains and sewers, and to other valuable property underneath the surface of roads. He hoped the time was coming when Parliament would turn its attention to the necessity of controlling these engines, and limiting the weight of steam rollers. Another point was that all gas service pipes should be laid at such a depth as to be in a zone of equal temperature as nearly as possible all the year round, so as to minimize expansion and contraction. Therefore, services should be placed at a much greater depth than they usually were. Lead pipes, if used at all, should be laid in wooden boxes. In his district they used both kinds. The thin iron service pipes, however, had been abandoned; and he should no more think of putting such flimsy material in the ground than of putting in a piece of paper. Steam piping was what he used when iron was employed. Some mortars, and also some soils—soils containing engine ashes, with pyrites and sulphur—were very destructive to lead piping. They found this to be the case in many parts of the country; and it was an additional reason why, if lead were used, it should be protected by a wooden casing, or something of the kind. One of the speakers alluded to Mr. Veevers as introducing this question to them for the first time. It was not the first time that the question had been discussed. Mr. Chew gave them a paper on the subject when they visited Barnsley some years ago; and it was discussed at that meeting. He (the President) must not be understood to be complaining, however, for he agreed with the observation previously made that it was desirable these things should be reconsidered after a lapse of time; and he thought Mr. Veevers had acted very wisely in bringing it before them again.

Mr. Veevers said he was bound, by considerations of the time at their disposal, to be as brief as he possibly could in his reply to the various speakers; and he should only allude to the more important points raised. In the first place he must say that he had been in a high state of nervousness as to what Mr. Isaac Carr would have to say on the subject; for he threatened when the paper was read to come and "have it out with him." However, he had had only a gentle tap with velvet instead of a blow with a mallet; and he was exceedingly pleased with the kind way in which Mr. Carr had spoken on the matter. As to the difference in cost between lead and iron services, he had only to say that when he came to consider the subject, he took the actual cost of the lead and the iron pipes from the books in the Dukinfield Gas Department. For some time they had been using iron services; but he abandoned the practice, as he could stand it no longer. They had continual complaints of escapes of gas, and pipes were brought in corroded away and full of holes. Well, as he had said, the actual cost of laying iron and lead services was taken from the books; so that his figures were the actual *bona fide* cost, and not estimates. When iron was used it was ordinary iron tubing; so that if steam piping was employed it would very much exceed the figure he had put down as the cost of the iron. As to the laying of services in the way he had described, it would be found to be almost the universal custom in Manchester. He did not think there was very much difference in the cost of passing the one or the other through the wall. Mr. Carr said he had put more joints to the iron piping than was necessary; but if he admitted this, and allowed two joints to be taken off, it still left eight for the iron service as against three for lead, which was a very important matter in avoiding leakage. As to the remarks of Mr. Newbigging, he did not mean to say that they should always lay the mains on each side of the road. But on the broad principle he should lean to this course, because there were so many reasons for taking up the road for sewerage and water operations; and there was also the laying down of good roads, and so on, that speaking generally, he should say the lesser evil was to put mains in the footpaths on either side. As to their being near the house, he never in his whole experience found more than one case in which an escape of gas was caused by laying the mains in this way; and in this instance it was owing to a drain running under the service. Even if they had well-made roads (such as most of them now were) and the gas escaped, it was almost sure to get into the houses. He found that the mains were, as a rule, crushed very little indeed; and as for water getting into the services, he did not remember a single case of the kind in Dukinfield. If he had an extra long length of service pipe to lay with very little fall, he should then, as Mr. Duxbury did, put a slab under it; the pipe could not slip sideways. But he should not adopt the system in vogue at

Sheffield, where the services were laid in a triangular box, as he thought they would do so. Lead services did not require so much setting up as Mr. Elliott seemed to imagine. If they had the main under the footpath, there was not the same length of service required; and there was little danger of sagging. Mr. Newbigging mentioned an instance in which lead services had rotted after six months' use. He should like to know what in this case would have been the result with iron pipes?

Mr. Newbigging said the character of the ground had a special action upon lead. It was a yellow clayey soil.

Mr. Veevers said if this was the case it would be very interesting to know what was the nature of the soil chemically, and try the experiment with both iron and lead.

Mr. Newbigging remarked that he got rid of the lead services and tried iron ones, and he had no more trouble.

Mr. Veevers asked how often a case of this kind occurred. He would be bound to say that they found four or five times the number of cases in which iron was affected in this way to one in which lead was so affected. In conclusion, he thanked the various speakers for their kind expressions of approval.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Two Big Roofs in which the Gas Men had a Hand.—Messrs. M. Ehret, Jr., & Co., of Philadelphia, Pa., who are known from Maine to California as the manufacturers of a first-class article of roofing felt, have recently completed the job of roofing the mammoth structures known as the State Fair buildings, at Dallas, Texas. About 2,500 rolls of roofing material were required. The same parties roofed the State Fair buildings at Raleigh, N. C., and over 2,000 rolls of felt were employed in the operation. These instanees show how some of the gas tar of the States was absorbed, and the end is not yet, for the myriads of houses now being constructed in the "far west" and "down south" must be roofed in, and properly prepared felt fills the bill completely.

Mr. Jos. Bate Goes to Muncie, Ind.—Mr. Joseph Bate, after 14 years of active and honorable service spent in the employ of the Tiffin (Ohio) Gas Light Company, as its Secretary and Superintendent, has removed to Muncie, Ind. Mr. Bate's new duties oblige him to take charge of the gas and water supply of Muncie, and it is needless to add that he is well qualified to assume such control. We believe that the Muncie Gas Company, and the water company as well, are operated or owned by the American Water Works and Guarantee Company, whose chairman is Mr. D. W. Hitchcock, of Marlboro', Mass. The Tiffin folks, naturally enough, did not want to lose Mr. Bate's services, but no fault can be found with his course since the change signified better business prospects for himself. Mr. H. McCall, who served as assistant to Mr. Bate at Tiffin for a half score of years, is now in charge of the Tiffin works as Superintendent, and we are unable at present to say who will be chosen by the owners to fill the office of Secretary.

Something from Portsmouth, N. H.—On the first of July last the management of the Portsmouth Gas Light Company made public a new schedule of selling rates, which action has since resulted in a decided increase in the daily sendout. The former gross rate to ordinary consumers was placed at $3 per thousand cubic feet, but prompt payment secured a rebate of ten per cent., which, of course, figured out to a net price of $2.70 per thousand. The July manifest contained the statement that the new gross charge would be placed at $2.50, while the prompt payment discount would remain as before, thus making a net rate of $2.25 per M. Consumers, who, according to the scale of consumption, would not be included in the list of ordinary users, are entitled to an extra discount of ten per cent., and these are, therefore, supplied with gas at $2 per thousand. Mr. F. J. Philbrick, who is Treasurer of the Company, and to whom we are indebted for the facts given, says there is every likelihood that prices will go still lower. He also informs us that extensive improvements have been made to the manufacturing plant, which is now in first-class condition, and adds: "We are passing through the usual 'spasms' incident to the introduction of electric light, and do not feel in anywise alarmed. In fact we feel assured we will come out of it all right. We propose to mind our own business, to make the best gas we can, and sell it as cheaply as we can afford." Sentiments indicative of the wish of the Treasurer and his associates to carry out a line of action that may be counted upon to return a substantial reward to the propounders thereof. The Portsmouth Gas Company was incorporated in 1850, and shows no other signs than those which are identified with vigorous strength and healthy growth.

Some Pittsburgh, Pa., Gas News.—Brother Denniston, of the East End Gas Company, is putting in the apparatus necessary to work under the McKay-Critchlow patented method of fitting natural gas to the ordinary uses of the East End Company's patrons. The McKay-Critchlow patents, as before stated in these columns, are owned by the American Gas Improvement Company; and this company is now furnishing complete apparatus destined for use in Meadville, Warren, Oil City, Franklin, and Greensburgh, Pa., and at Fostoria, Ohio. Beaver Falls and Titusville, Pa., and Salamanca, N. Y., already have the process in satisfactory and successful use. The Springer cupola is the sort put up, as a rule, by the Improvement Company. At the old Allegheny gas works Mr. Robert Young has added an auxiliary water gas plant on the Granger plan. Mr. McElroy, of the old Pittsburgh Company, is now working one of the Granger class, while Mr. Bennett, of the Consolidated Company, is putting in an auxiliary plant of the Flannery class. Between all these systems the Pittsburgh gas consumer can hardly find fault or claim that the gas suppliers of that place are not willing to give him the benefit of the "latest thing out" in the matter of illuminating gas. All he has to do now—as before—is to pay his money and take his choice. It is said by those conversant with the facts that the illuminating power of Pittsburgh gas now averages over 18 candles.

Electric Companies Added to the List.—The Charleston (S. C.) Electric Light Company, with a capital stock of $60,000, is presided over by Mr. Geo. B. Edwards; P. P. Toole is Secretary and Treasurer. The Thomson-Houston system will be employed. The Western Electric Lighting Company, to operate in the city of Columbus, Ohio, appears to be under the control of Geo. L. Converse, Jr. The capital stock is placed at $25,000. Mr. Converse must have an abundant faith in the value of electricity as a lighting agent to select Bro. McMillin's gas district as the field wherein he proposes to operate. The Zanesville (Ohio) Electric Light Company is capitalized at $25,000. Geo. R. Fox seems to be the controlling spirit in that enterprise. The Electric Company, of Saco, Me., has been incorporated. It is capitalized in the sum of $500,000—which ought to be sufficient. Wm. Butterfield, of Boston, Mass., is its President; and F. Swift, of New Bedford, Mass., will sign himself as Treasurer. The Malone (N. Y.) Electric Light and Power Company will try to carry on its business under a capitalization of $25,000. P. H. Shields seems to be the prime mover. The Deerpark Electric Light Company will endeavor to earn dividends on a capitalization of $30,000 at Port Jervis, N. Y. Geo. M. Beebe figures as its ostensible organizer.

Progress at Franklin, Ind.—The managers of the Franklin Gas Light Company having decided to try the plan of selling cheap gas, notified their patrons some time ago that ordinary consumers would be supplied at a charge of $2.50 per thousand cubic feet. In all instances where the consumption per month reaches 2,000 cubic feet the further concession of 50 cents per M. is granted. The former charge was $3 per thousand, and the new schedule will be noted as a decided cut. Franklin is increasing in numbers and wealth, and one result of the growth is that the gas company has been ordered, during the last summer, to erect 19 additional street lamps. The erection of the posts, however, entailed upon the company a pretty stiff expenditure, since the points of separation were so great that over 7,000 feet of mains had to be put down to ensure a gas supply. Possibly the Franklin City Council will bear that fact in mind if ever a future contest should arise in regard to the public lighting; but we fear there is greater likelihood that in such an emergency the good deeds of the past will fail to count to the credit of the Franklin Gas Company. At any rate, it is better to do what is right in the present, for no matter if the good that was done is forgotten, it cannot be said of the reverse side of the case. The dear public possesses a wonderfully tenacious memory in regard to the shortcomings of what it is pleased to term a "grasping monopoly," and it is hardly necessary to say that a gas company appears in the field of the vision of the aforesaid dear public as a particularly hideous specimen of the "grasping," etc. Previously no new posts had for years been ordered by the Franklin authorities, but they seem to have at last tired of their Rip Van Winkle-like policy.

Street Lighting at Buffalo, N. Y.—The electricians in Buffalo have made considerable advance in the matter of securing control over the public lighting of that city, but the gas companies yet hold the balance of public favor "by a large majority." The bills presented for the lighting services performed during the month of September by the various companies were as follows:

Buffalo Gas Light Company.....	$8,611,30
Mutual Gas Light Company.....	3,934.50
Citizens Gas Light Company.....	1,783.31
Brush Electric Light Company.....	8,988.10
Total for September.....	$23,317.21

The gas lamps are fitted with burners rated to consume four cubic feet per hour but the real quantity passed will average 4.2 cubic feet. The Brush lamps are of the regulation 2000-candle power standard, and those who have seen the Buffalo samples in duty assert that they are very poor specimens of the Brush type. It is the general opinion that the Buffalo authorities are not disposed to sanction any further increase in the electrical branch of the

public lighting; indeed, to the contrary, an impression gains ground that a curtailment is more like what the future is to bring forth. The following schedule of lighting hours in the respective months may be of interest. It applies to both classes of lights:

	Lighted at.	Extinguished at.
January	5:20 P.M.	6:20 A.M.
February	5:50 "	5:50 "
March	6:50 "	5:20 "
April	7:20 "	4:50 "
May	7:50 "	4:20 "
June	8:20 "	3:50 "
July	8:20 "	4:20 "
August	7;20 "	4:20 "
September	6:20 "	4:50 "
October	5:50 "	5:20 "
November	5,20 "	5:50 "
December	5:20 "	6,20 "

In consequence of the reports made by the Lamp Inspector, T. A. Collins, for the month of September—whose duties include that of collecting from police headquarters the statistics relative to the number of lamps unlighted on each schedule night—48 lamps were deducted from the bill of the Buffalo Gas Company; 49 from that of the Mutual Company; and 38 from that of the Brush Company.

THE YOUTH AND HIS LITTLE MATCH.—A despatch to the Associated Press, from Wheeling, West Va., dated Oct. 4, says that on the previous day an urchin living on the line of the Wheeling Natural Gas Company's conduits, discovered "a small leak in a 12-inch pipe, and applied a match 'to see the gas burn,' as he afterwards explained. He was unable to extinguish the fire, and, by degrees, the lead packing of the joint melted and ran out. The fire increased in volume until this morning (Oct. 4) the pipe broke, and a mass of flame, upwards of 50 feet in height, shot into the air with a deafening roar. The result was to cut off the supply of gas from the city. All the mills and factories in Wheeling, Martin's Ferry, Ætnaville, Bellaire, and Bridgeport, employing in the aggregate several thousand men, had to close down until repairs could be made and the gas again turned on." Of course, the gas company lost no time in repairing the damage; and we are further informed that the imaginative fancy of the Associated Press reporter made out a much more serious state of affairs than was actually the case.

STILL ORGANIZING.—The number of investors anxious to put their money into schemes connected with the development and supply of natural gas shows no diminution. Of course, the Mecca of the natural gas investor is to be found either in Pennsylvania, Ohio, or West Virginia; but as "all's not gas that smells," we fear that many of those who are in hot haste to strike the promised vein will have leisure to repent in the future over the misdirected zeal of the present. In fact many are now ruefully reposing on the stool of repentance; although they may possibly extract solace from the knowledge that the legs of the stool were placed in the ground by themselves.

CHEAPER GAS FOR CONNERSVILLE, IND.—Mr. J. D. McNaughton, Superintendent of the Connersville Gas Light Manufacturing Company, informs us that on September 20th the following notice was published: "We take pleasure in announcing to the consumers of gas in this city that we have reduced the price of gas from $2.50 to $2 per thousand cubic feet, and a discount of 10 per cent. will be allowed (on even dollars only) for prompt payment. Bills rendered October first will be made at the reduced price." The prompt payment clause obliges that accounts be settled within four days from presentation of bills. At the same time a new sales rate for coke was adopted, and the rates are appended: Uncrushed coke, $2 per cartload of 25 bushels; and purchasers of 100 bushels at one time will be charged but $1.75 per load. Crushed coke, per cartload of 25 bushels, is to be sold at $2.50; and buyers of 100 bushels will receive that quantity for the sum of $9. The crushed coke is thoroughly screened before delivery, and is in every respect a clean, satisfactory and economical fuel. In fact the Connersville gas men have no hesitancy in guaranteeing that 50 bushels of the crushed coke product will equal the results secured from the employment of one ton of anthracite coal in ordinary and everyday domestic use. The local coke market has been carefully looked after by Mr. McNaughton, and the consequence is that that residual has become quite a favorite with the residents of Connersville. The best quality of Second Pool Youghiogheny coal is carbonized in the Connersville gas works, hence a good merchantable article of coke is always on sale there. Our readers, of course, will agree in the belief that $1.80 per thousand cubic feet is a very cheap gas rate to maintain in a place like the one under consideration. We think it may possibly contain a population of 5,500 souls; certainly the number is not in excess of that total.

SETTLEMENT OF THE CHATTANOOGA GAS WAR.—We have official advice that the wasteful and extravagant gas war which was waged between the old Chattanooga Gas Light Company and the opposition water gas company's manipulators was finally brought to a close on date of October 1st. The old company bought out the entire plant and franchises of the opposition concern (which was at the outset and on paper to do such great things for the local gas consumers) at its own figure and on its own terms. The purchasers were to take formal possession of the newly-acquired property on or about Oct. 9th, when the water gas plant will be shut down, at least for the present; but in any event it will only be operated for a short while, or during the time of heaviest winter output. The price of gas has been adjusted to the figure of $2 per thousand cubic feet, which is a reasonable charge, especially in view of the manner of action pursued by the city authorities when they granted commercial life to the opposition gas schemers—or blackmailers. If the authorities had been possessed of ordinary common sense the old Chattanooga Gas Light Company would not now be saddled with a useless plant—no matter if it did not come very high—and the gas rate would not be at the $2 notch. Mr. J. A. Caldwell remains in the Presidential chair of the company, and his able lieutenant—who had the brunt of the fight all through the warfare—Mr. J. T. Lynn continues on as Secretary and Superintendent. Perhaps Knoxville might take a lesson from the Chattanooga affair.

THE WALTHAM (MASS.) GAS COMPANY TO SUPPLY ELECTRICITY.—It appears that the difficulties in the way of settling the lighting interests of Waltham have been surmounted. It will be remembered some time since we mentioned that the directors of the Waltham Gas Light Company were endeavoring to secure the unanimous consent of their shareholders to the operation of a combined electric and gas plant; but it appears unanimity of action failed, it is said, on account of sharp practice indulged in by the already chartered local electric company. The story goes that someone interested in the electric incorporation purchased one share of the stock of the gas company in time to vote it in the negative on the proposed action, hence the lack of unanimity. Of course, that is merely given for what it is worth. Defeated in their original attempt, the gas company's directors instituted negotiations with the electricians, and the following, from a Boston correspondent, outlines the result:

"The electric light company and the Gas Company in Waltham have been consolidated. A meeting of the stockholders of the Gas Company was held on September 25th, and they voted to change the by-laws in several respects necessary to legalize the proposed action. The number of directors was increased from 5 to 9. Nearly 800 out of the 1,300 shares were represented, and the vote was unanimous. Owing to his inability to attend to the business, Mr. Arthur T. Lyman, one of the directors, tendered his resignation, which was accepted. Messrs. Lowell Clark, Geo. A. Stearns, Jas. Gooding, Jno. R. Farnum, C. C. Bills, Wm. Roberts, C. E. Getchell, M. H. Young, and Mr. Goodale were chosen to form the new board. From remarks made to those in attendance at the meeting, by Mr. Farnum and Dr. Adams, it was learned that the proposal offered by the electric company as a basis of settlement between the two companies had been modified, by mutual consent, in such a manner that the electric plant will be constructed under the supervision of a building committee composed of an equal number of members from each board of directors, and the interests of both companies would consequently receive due consideration." This last "explanation" is decidedly "foggy," but we suppose it to mean that of the nine directors named a certain number will be assigned to take charge of the gas supply, the remaining ones to be in control of the electric department. The name of the new corporation will be "The Waltham Gas and Electric Lighting Company," and it is supposed that provision will be at once made to carry on the latter portion of the company's business.

STREET LIGHTING AT TOLEDO, OHIO.—In our item columns for August 16th we noted that the Toledo Gas Light Company, in submitting bids for street and private lighting, given in response to an invitation from the city to estimate on the basis of a five-year contract, was prepared to make some remarkable concessions. The city, however, refused to accept any of the propositions then made, and readvertised for proposals, based on a two-year contract, with the following result—the bids were opened on the morning of October 4th: The Toledo Gas Light and Coke Company offered to supply the lamps in city west of Maumee river with 17-candle power gas at the rate of $1.25 per thousand; and to supply private consumers at a charge of $1.35 per thousand, less ten per cent. off if accounts were settled within five days. The same company also proposed to light, extinguish, and keep in repair, lamps to be operated on the suggested new burning hour schedule for the sum of six cents each per night; or to furnish, at the present schedule, light, etc., during 365 nights in the year, at a charge of 5 cents each per night. A third proposition was to maintain any required number of high power burners, each one, to use the words of the proposal, "to give as much light as the so-called 2,000-candle power standard arc lights," for the sum of 40 cents each per night; or if left alight, in accordance with the present schedule, to maintain the same for 33 cents each per night. The Toledo Electric Company proposed to furnish arc lights of 2,000 candle power, during 300 nights in the year, at 55 cents per light per night, or on 365 nights in the year for 50 cents each. To private consumers the electricians would furnish 16-candle power incandescent lights for the sum of $1.25 each per month, the lights to be extinguished at midnight. Comparing these figures with those published two months ago, it will be seen that the gas company has made a slight increase in its rates, while the electricians have taken the other tack. Nevertheless, the gas men are still well to the fore in the item of cheapness, and if merit and economy are to determine the policy, Toledo will still continue to patronize the light of the present.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—JOS. R. THOMAS, C.E.
Manager—C. E. SANDERSON.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY, VENTILATION, SANITARY IMPROVEMENT, AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS CO. 39 and 41 Chambers St.
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 72 Buckingham St., London, W C.
Germany—B. WESTERMANN & Co., of New York

SATURDAY, OCTOBER 16, 1886.

THE *Coal Trade Journal* says: "Civilization gets its supply of coal and iron at a costly expense of human life. A Parliamentary paper which has just been published shows that during the year 1885 the total number of fatal accidents was 866, and the total number of deaths occasioned thereby 1,214, showing a decrease compared with the totals for the preceding year of 51 in the number of fatal accidents, and an increase of 216 in the number of lives lost. On an average during the year there was one fatal accident to every 648 persons employed, and one death by accident to every 462 persons employed. The average for the ten years 1874 to 1883, is one fatal accident to every 594 persons employed, and one death by accident to every 458 persons employed."

The Market for Gas Securities.

Consolidated has been the feature of the city gas share market during the fortnight, and the developments were all on the bull side. At time of writing (noon, Oct. 14) 80¾ is bid, but holders stand out for one-half point higher. The number and variety of excuses put forward by brokers on the bear side are at once amusing and ridiculous. Kiernan's news agency cards, dated Oct. 13, intimate that the managers of the Consolidated Company contemplate disposing of about fifteen million dollars' worth of real estate, with the intention of devoting the receipts to retire a certain amount of the capital stock. Pure bosh; except in so far as it shows that the bears are inclined to speak respectfully of the value of the company's real property. Messrs. Walden & Lawrence are especially frantic over the rise. These operators, who have adhered to the short side of the market with surprising and reckless perticinacity, recently furnished telegraphic information to their customers that "a conservative director told them not more than 1½ per cent." of a dividend would be declared at the semi-annual meeting, because only that per cent. had been earned. We have no advices from "conservative directors" in the management of the corporation; but we will nevertheless predict that the rate of dividend is to be slightly increased. Other city shares are dull and weak. The Brooklyn situation remains practically unchanged, although a healthier undertone seems to have been established. The outlook, however, is far from promising. The Fulton Municipal, Brooklyn, commenced paying its regular quarterly dividend (3 per cent.) on Oct. 15th. Boston (Mass.) gas is very strong; and it is quite likely higher figures will rule in it during the winter. Laclede (St. Louis) gas is on the upward move, and Baltimore Con. is also in the ascending scale. The Montreal (Can.) Gas Light Company has declared its regular semi-annual dividend of 6 per cent, payable since yesterday. The situation, taken as a whole, ought to be satisfactory to investors.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

OCTOBER 16.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	81	81½
Central	440,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	107	110
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	113	—
Mutual	3,500,000	100	101½	103
" Bonds	1,500,000	1000	104	106
Municipal, Bonds	750,000		—	—
Northern	125,000	50	36	—
" Scrip	108,000			
Yonkers		50	51	55
Richmond Co., S. I.	300,000	50	50	—
" Bonds	40,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	112
Citizens	1,200,000	20	65	67
" S. F. Bonds	320,000	1000	—	105
Fulton Municipal	3,000,000	100	144	147x
" Bonds	300,000		--	105
Peoples	1,000,000	10	65	67
" Bonds	290,000	—	—	103
" "	250,000	—	—	102
Metropolitan	1,000,000	100	—	80
Nassau	1,000,000	25	109	111
" Ctfs	700,000	1000	—	101
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	—	111
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	130	138
" " Bonds.	124,000	—	105	110
Chicago Gas Co., Ills.	5,000,0000	25	128	135
Peoples G. L. & C. Co., Chicago, Ills	3,000,000		8	12
Cincinnati G. & C. Co.			190	194
Consolidated, Balt.	6,000,000	100	52	—
" Bonds	3,600,000		107	107½
Chesapeake, Balt.	1,500,000	100	—	70
"	1,000,000		100	102
Central, S. F., Cal.			70	72
Capital, Sacramento, Cal.			54	56
Hartford, Conn	750,000	25	140	142
Jersey City	750,000	20	155	—
Laclede, St. Louis, Mo.	1,600,000	100	110	112
Louisville, Ky.	1,500,000	50	118	121
Little Falls, N. Y.	50,000	100	95	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	209	215
New Haven, Conn.		25	190	195
Oakland, Cal.			35	35½
Peoples, Jersey City		—	25	30
" " Bonds			—	—
Paterson, N. J.		25	90	—
Rochester, N. Y.		50	75	80
St. Louis, Missouri	600,000	50	—	475
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	59	60
Memphis (Tenn.) Gas	750,000	100	80	82
" Bonds.	240,000	100	103	—
Washington, D. C.	2,000,000	20	190	—
Wilmington, Del.		50	205	215
Havana (Cuba) Gas Co.	3,000,000	100	18	20
" Bonds	550,000		102	—

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 250
Wm. Henry White, New York City ... 250
Wm. Farmer, New York City ... 250

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd, New York City ... 253
T. F. Rowland, Greenpoint, L. I. ... 253
Delly & Fowler, Phila., Pa. ... 253
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 253
Stacey Mfg. Co., Cincinnati, Ohio ... 253
Bartlett, Hayward & Co., Baltimore, Md. ... 253
Morris, Tasker & Co., Limited, Phila., Pa. ... 252
Davis & Farnum Mfg. Co., Waltham, Mass. ... 252
Tanner & Delaney Engine Co, Richmond, Va. ... 252
R. D. Wood & Co., Phila., Pa. ... 252
Southwark Foundry and Machine Co., Philadelphia, Pa. ... 252

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills. ... 254

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa. ... 250
Warren Foundry and Machine Co., Phillipsburgh, N. J. ... 250
Mellert Foundry and Machine Co., Reading, Pa. ... 250
Cincinnati and Newport Iron and Pipe Co., Newport, Ky. ... 250
John Fox, New York City ... 250
Ohio Pipe Co., Columbus, Ohio ... 250
Pancoast & Rogers, New York City ... 250
M. J. Drummond, New York City ... 250

GAS ENGINES.

Schleicher, Schumm & Co. Phila., Pa. ... 258
Clerk Gas Engine Co, Phila., Pa ... 244

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J ... 248
B. Kreischer & Sons, New York City ... 248
Adam Weber, New York City ... 248
Laclede Fire Brick Works, St. Louis, Mo ... 248
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y. ... 248
Borgner & O'Brien, Phila., Pa ... 248
James Gardner, jr., Pittsburgh, Pa. ... 248
Henry Maurer, New York city ... 248
Chicago Retort and Fire Brick Works, Chicago, Ills. ... 248
Baltimore Retort and Fire Brick Co., Baltimore ... 248
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo. ... 248
Evens & Howard, St. Louis, Mo. ... 249
Cincinnati Gas Retort and Fire Brick Works, Cincinnati, O. 249
Emil Lenz, New York City ... 249

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 251

REGENERATIVE FURNACES.

Adam Weber, New York City ... 246
Bartlett, Hayward & Co., Baltimore, Md. ... 246

GAS GOVERNORS.

Connelly & Co., New York City ... 245
T. C. Hopper, Phila., Pa ... 246

CEMENTS.

C. L. Gerould, Manchester, N. H ... 242
Howard Fleming, New York City ... 242

GAS ENRICHERS.

Forest City Naptha Co., Cleveland, Ohio ... 246

GAS METERS.

Harris, Griffin & Co., Phila., Pa. ... 256
American Meter Co., New York and Philadelphia ... 257
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa. ... 257
Helme & McIlhenny, Phila., Pa. ... 257
Maryland Meter and Mfg. Co., Baltimore, Md. ... 256
D. McDonald & Co. Albany, N. Y. ... 257
Nathaniel Tufts, Boston, Mass. ... 256

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind..... 249
Smith & Sayre Manufacturing Co., New York City..... 252
Wilbraham Bros., Philadelphia, Pa..... 254
Connelly & Co., New York City..... 246

GAS COALS.

Penn Gas Coal Co., Phila., Pa..... 255
Perkins & Co., New York City..... 254
Newburgh Orrel Coal Co., Baltimore Md..... 255
Despard Coal Co., Baltimore, Md..... 255
Chesapeake and Ohio R.R. Coal Agency, N. Y. City..... 255
Westmoreland Coal Company, Phila., Pa..... 255
Monongahela & Peters Creek Gas Coal Co., Pittsburgh, Pa.. 255

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y..... 246
John McLean, New York City..... 246

GAS LAMPS.

The Siemens-Lungren Co., Philadelphia, Pa..... 251
G. Shepard Page, New York City..... 214
Albo-Carbon Light Co., Newark, N. J..... 243
Crystal Carbon Light Co., Phila., Pa..... 242

PURIFIER SCREENS.

John Cabot, New York City..... 242

GAS STOVES.

American Meter Co., New York and Philadelphia..... 247
The Goodwin Gas Stove and Meter Co., Phila. Pa..... 226
Chicago Gas Stove Company, Chicago, Ill..... 242

STREET LAMPS.

J. G. Miner, Morrisania, New York City..... 241
Bartlett Street Lamp Mf'g Co., New York City..... 249

BURNERS.

G. Gefroter, Phila., Pa..... 242

PURIFYING MATERIAL.

Connelly & Co., New York City..... 85

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City..... 246

GAS FIXTURES.

Mitchell, Vance & Co., New York City..... 242

STEAM PUMPS.

A. S. Cameron Steam Pump Works, N. Y. City..... 249

STEAM ENGINES.

Westinghouse Machine Co., Pittsburgh, Pa..... 255

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 241
B. J. Allen, Newark, New Jersey..... 241

COAL HANDLING MACHINERY.

C. W. Hunt Company, New York City..... 246

BOOKS.

Gas as a Source of Light, Heat and Power..... 244
Goodwin's Directory of Gas Light Companies..... 244
The Chemist's Assistant..... 250
King's Treatise..... 257
Scientific Books..... 256
Management of Small Gas Works..... 250
Newbigging's Gas Manager's Handbook..... 248
Gas vs. Electricity..... 242

Superintendent's Position Desired

By a practical man of twenty-five years' experience in the manufacture and distribution of coal and water gas. Satisfactory references given. Address

646-tf "ENGINEER," care this Office.

Situation Wanted

AS SUPERINTENDENT OF GAS WORKS.

Can come well recommended as to character and ability. Address "GAS SUPERINTENDENT,"

653-6 Care this Journal.

SITUATION WANTED

As Superintendent of Gas Works.

Has filled the position of engineer and superintendent of gas works for eight years. Understands the manufacture and distribution of gas, laying mains and services, the fixture and fitting business, and keeping accounts. Good references given.

Or would prefer to lease a works in a good city or town of 6,000 or 10,000 inhabitants, and would endeavor to advance th interests of the stockholders.

Address GEO. M. McCONAUGHEY,
Care Austin Gas Lt. and Coal Co., Austin, Texas.

FOR SALE,

4 Plain Inside Hanging Siemens Lamps,

Complete and in good order. $25 each. Taken from a rink for debt, and sold for want of use. Apply to

GAS LIGHT COMPANY,
655-2 NEW BRUNSWICK, N. J.

FOR SALE,

Gas Works

IN A GROWING WESTERN CITY.

Reason for selling, owner's inability to give his attention to the business. Address

655-8 P. O. BOX 438, GREEN BAY, WIS.

Notice to Gas Companies.

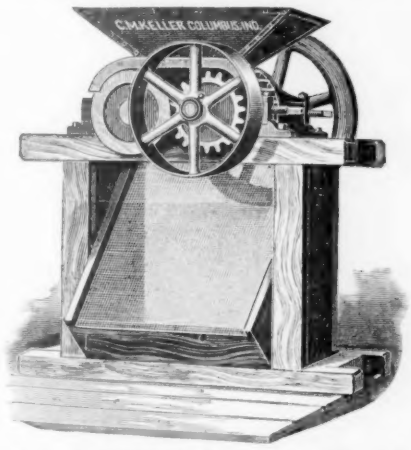
We desire to inform you that letters patent of the United States No. 345,368, applied for on November 21, 1885, were issued to us on July 13, 1886, for an improvement in Automatic Gas Governors, which improvement is set forth in the claim of said patent as follows, viz.:

"The combination of an automatic gas governor so constructed as to automatically increase or diminish the pressure at its outlet in proportion to the volume of gas passing through it, and an adjustable valve so constructed and arranged as to be capable of adjustment to pass different volumes of gas without changing the length of stroke or travel, substantially as and for the purpose specified."

We desire to notify you that we consider that any automatic gas governor having such an adjustable valve is covered by the said patent, and that all automatic governors containing such valves not made by us are infringements of our said patent. We give this notice that all persons may be informed of our claim, so that no one may ignorantly infringe upon our rights.

Very respectfully,

T. E. & J. S. CONNELLY,
Of CONNELLY & CO., LIMITED.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

PATENTED

GAS COMPANIES, ATTENTION!

Increase the demand for Coke by using the

Star Coke Breaker.

SIMPLE, CHEAP, DURABLE. EASILY SHARPENED BY ANY BLACKSMITH.

B. J. ALLEN, Newark Gas Co., Newark, N.J.

THE GLOBE STREET LAMP.

MINER'S PATENT STREET LAMPS.

Are adapted for use of Streets, Parks, Depots, Ferries, & Private Grounds.

WITH POSTS OR BRACKETS.

Jacob G. Miner,

No. 823 Eagle Ave., New York N. Y.

TO ALL WHOM IT MAY CONCERN.

Notice is hereby given that a suit is now pending in the U. S. Circuit Court for the Northern District of Illinois against the Chicago Gas Apparatus Manufacturing Company and Newman A. Ransom, for infringing our rights under Letters Patent of the United States No. 247,925, dated October 4th, 1881, and No. 333,862, dated January 5th, 1886; and that a similar suit for like infringement has been instituted against W. S. Horry (trading as the Crystal Carbon Light Company), Arthur Kitson (trading as Kitson & Co.), and others, in the U. S. Circuit Court for the Eastern District of Pennsylvania. All persons in anywise infringing upon our rights under said Letters Patent will be prosecuted by us upon our obtaining proof of such infringement.

WALTER J. KIDD, General Manager.

THE ALBO-CARBON LIGHT COMPANY, - - NEWARK, N. J.

SOLE MANUFACTURERS FOR THE UNITED STATES.

"CHICAGO" Gas Stoves

MEET A LONG-FELT WANT, IN THAT THEY ARE

ATTRACTIVE IN APPEARANCE,

Economical in Consumption,

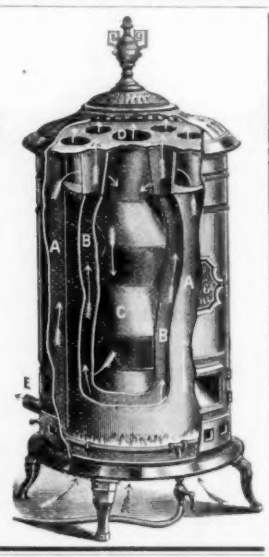
AND

MOST EFFECTIVE AS HEAT PRODUCERS.

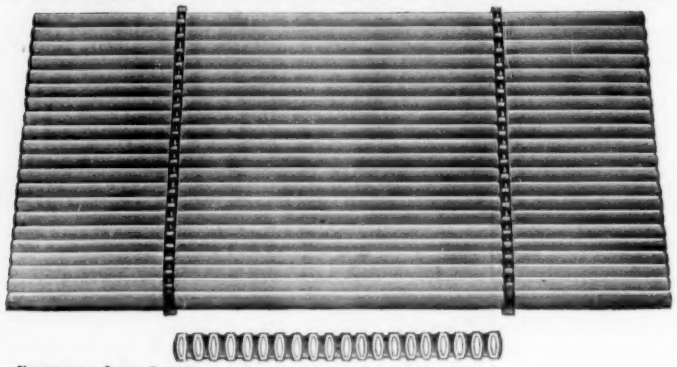
MANUFACTURED BY THE

CHICAGO GAS STOVE CO.

69 Lake St., Chicago, Ill.



CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



PATENTED JULY 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

306 to 310 11th Av., N. Y.

References in all parts of the country. Send for circular and list of companies who now have the Screen in use.

HOWARD FLEMING,

23 Liberty St., New York.

IMPORTER of

"BRIDGEND" "DINAS"

Silica FIRE Bricks

FOR COKE OVENS AND GAS WORKS.

PORTLAND AND ROMAN CEMENTS.

Correspondence Invited. Lowest Prices.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila., Pa.

GIBBS PORTLAND CEMENT

Is guaranteed to be the finest English brand, and unsurpassed by any grade imported for making concrete and setting masonry.

Extract of Paper, with tests, read before the American Society of Civil Engineers, sent on application.

HOWARD FLEMING,

Sole Agent for U. S.,

23 Liberty St., New York.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD,

Manchester, N. H.

MITCHELL, VANCE & CO.,

MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocks, warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

GAS vs. ELECTRIC LIGHT.

We would invite attention to the able and exhaustive argument of General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Company, contained in a handsome pamphlet of 96 pages, entitled

"EDISON'S INCANDESCENT ELECTRIC LIGHTS FOR STREET ILLUMINATION. REPORT OF AN ARGUMENT DELIVERED BY A. HICKENLOOPER BEFORE THE COMMITTEE ON LIGHT, MUNICIPAL COUNCIL, CITY OF CINCINNATI, JULY 22, 1886."

This is a subject of special interest to all Gas Light Companies.

Prices.

50 copies.....	$12.50	250 copies.....	$50.00
100 copies.....	22.50	500 copies.....	87.50

A sample copy will be sent by mail on receipt of 50 cts.

A. M. CALLENDER, & CO., 42 PINE ST., N. Y. CITY

TRADE MARK.

THE CRYSTAL CARBON LIGHT!

The Latest and Most Improved Gas Light!

ADAPTED FOR PRIVATE RESIDENCES, CHURCHES, THEATERS, STORES, ETC.

These Burners are manufactured on the principle of enriching gas by means of Naphthaline (so-called Crystal Carbon or Albo-Carbon), the invention of the Rev. W. R. Bowditch, F.R.S., of Wakefield, England, who was the original inventor and patentee of this system of gas lighting.

SPECIAL NOTICE.

Many Gas Companies find the Crystal Carbon Light a valuable competitor against the Electric Light. It is ornamental, free from the defects common to all other enriching gas burners, and is as cheap as ordinary gas chandeliers. We sell direct to gas companies, giving them the benefit of agents' discounts.

CARBONCRYSTAL.

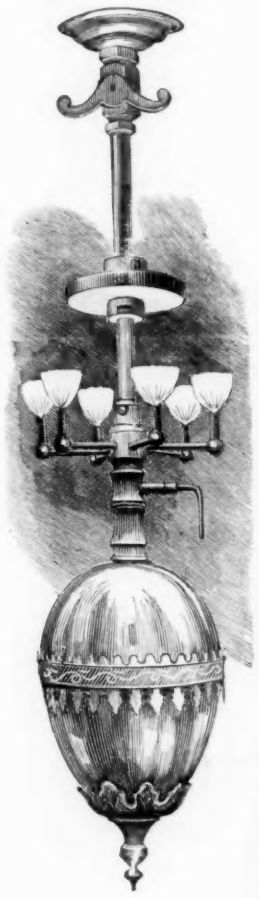
(Trade Mark.)

A new and superior preparation for enriching gas used in conjunction with Crystal Carbon or Albo-Carbon gas lights. The preparation is cleaner and better adapted for filling burner vessels than any hitherto produced. Guaranteed to be chemically pure. Supplied in cans from 10 pounds up.

THIS IS THE CHEAPEST AND PUREST FORM OF ENRICHING MATERIAL.

CRYSTAL CARBON LIGHT CO.,

Main Office, No. 1018 Chestnut Street, Philadelphia, Pa.



THE ALBO-CARBON LIGHT.

This most successful of all methods of enriching gas is based on the use of heated gas to vaporize a solid hydrocarbon, thus

COMBINING THE ADVANTAGES OF PREHEATING AND CARBURETTING.

The incoming gas passes over an extended heating surface (heated by means of the illuminating flames), and is raised to the temperature necessary to vaporize the carburetting material, which is a white, crystaline solid prepared from coal tar.

Two Seasons of Practical Use in all parts of the Country have amply demonstrated that the Albo-Carbon Light stands unrivaled for

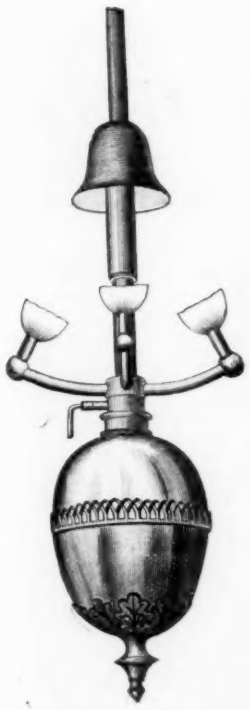
ECONOMY, BRILLIANCY, EFFICIENCY.

Gas Companies are Finding this System Superior to All Others

in enabling them to meet competition, as its adaptability to various requirements makes it equally as desirable to replace a KEROSENE LAMP, an INCANDESCENT LIGHT, or an ARC LIGHT.

Our Apparatus are made in all Sizes, from 1 to 48 Lights (25 to 1,500 C. P.)

To enable Gas Companies to still more successfully meet this competition and to offer to the public still cheaper forms of our lights, we have added



New and Attractive Designs at Low Prices.

Send for Illustrated Catalogue and New Price List.

NOTICE.

Suits are pending in the U. S. Circuit Courts in Illinois and Pennsylvania against various persons for infringement of our Letters Patent No. 247,925, dated Oct. 4, 1881, and No. 333,862, dated Jan. 5, 1886. All persons are cautioned against manufacturing, selling, or using any apparatus or material which infringes our Patents. We intend to commence suits against all parties infringing Patents owned by us.

The Albo-Carbon Light Co.,

NEWARK, N. J.,

Sole Manufacturers for the United States.

GAS ENGINES. GAS ENGINES. BOOKS.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

GAS

AS A SOURCE OF

LIGHT, HEAT, AND POWER.

By C. J. R. HUMPHREYS.

A Pamphlet of twenty-n ne pages, treating of the use of Gas as a source of Light, Heat, and Power.

DESIGNED FOR DISTRIBUTION BY GAS COMPANIES AMONG THEIR CUSTOMERS AND OTHERS.

Price, 10 cents each, $5 per 100, $50 per 1,000.

Gas Companies can have their own imprint placed on cover without extra charge. All orders to be sent to

A. M. CALLENDER & CO.,

No. 42 Pine Street, N. Y. Citv.

GOODWIN'S DIRECTORY

OF THE

GAS LIGHT COMPANIES OF THE UNITED STATES & CANADA

Price, ... $10.00.

Orders may be sent to

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

CONNELLY'S

AUTOMATIC GOVERNOR FOR STREET MAINS.

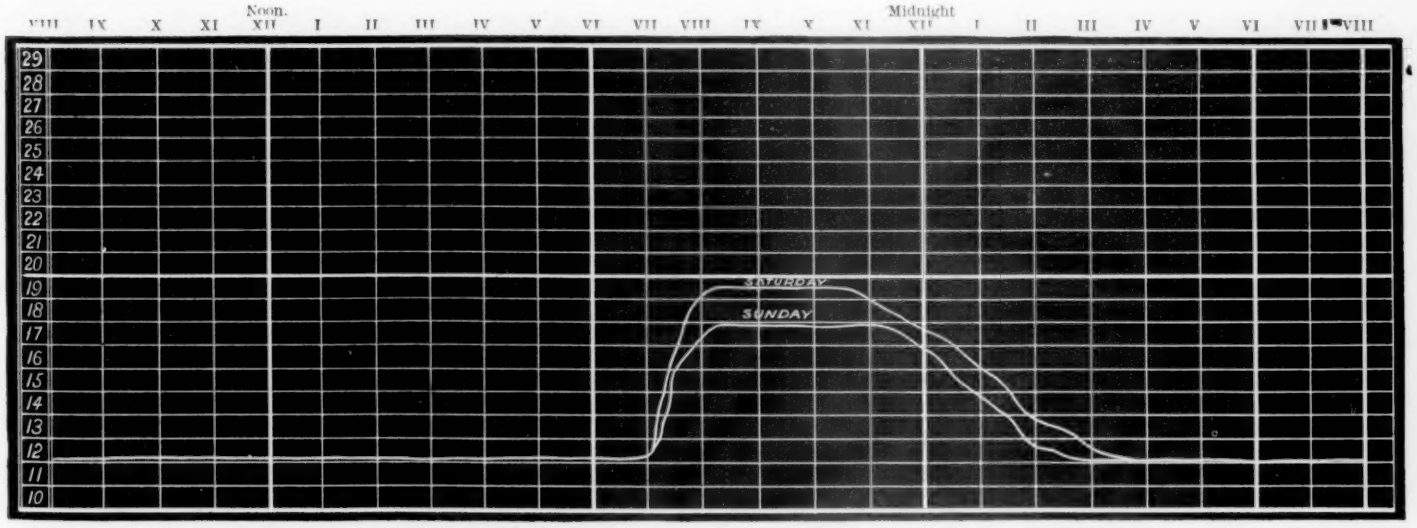
We invite the attention of all practical Gas Managers to the following letter and accompanying cut. The two lines show the pressure held by the Governor on Saturday and Sunday, and clearly illustrates the accuracy of the Governor in *increasing* and *reducing* pressure *in proportion to the volume of gas consumed.*

A Governor that puts the increased pressure on at "one fell swoop" and takes it off in like manner is *not* an "Automatic" Governor; and the circulation of pressure sheets showing such action by a so-called "Automatic" Governor is a rather amusing reflection on the intelligence of Gas Managers.

Strictly speaking, a "Balanced" Governor is an "Automatic" one, as it automatically varies the volume of gas sent out to *maintain a uniform pressure* at its outlet. But, as now applied, the term "Automatic Governor" is understood to mean a Governor that will *maintain pressure between any two desired extremes, in direct proportion to the volume of gas consumed.* Therefore pressure sheets showing *instantaneous changes* from maximum to minimum and *vice versa*, circulated broadcast as the record of an "Automatic (?) Governor," reveals inexcusable ignorance of the subject, amusing to many, yet liable to mislead the inexperienced novice.

We would suggest that all Gas Companies contemplating the placing of *Automatic* Governors would consult their own interests and avoid annoying experience by adopting a Governor *that has a record.*

CONNELLY & CO., LTD., 177 Broadway, N. Y.


Noon.
Midnight
VIII IX X XI XII I II III IV V VI VII VIII IX X XI XII I II III IV V VI VII VIII
29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10
SATURDAY
SUNDAY

Card Showing Pressure at the Milwaukee Gas Works, Saturday, July 10, and Sunday, July 11 1886.

MILWAUKEE, WIS., August 3d, 1886.

MESSRS. CONNELLY & CO., LTD., 177 Broadway, New York:

Gentlemen—Replying to yours of 29th, I send you a little package of register sheets. When your Governor (20-inch) was set I adjusted it to give 13-tenths day pressure and 22-tenths night pressure. Saturday nights it would run up to 25-tenths. Whenever it would cloud up in the daytime it would go up at first indication of darkness to about 15-tenths. I hunted back in the sheets to find one when pressure was increased in the daytime, but it is so long since we have had a stormy day I could not find one. You can, however, see a *slight change* on sheets for June 1 and June 25. You will see, too, that lately the Governor only puts on *about* 20-*tenths maximum pressure.* This is because *less gas is burned than when it was adjusted.* We have no complaints of pressure, and everyone appears satisfied. In conclusion, can say the Governor has *never been touched* since it was first adjusted, and has at all times *done just the work we wished it to do.* Very truly yours, E. G. COWDERY, Engr. & Supt.

T. C. HOPPER'S

AUTOMATIC DIFFERENTIAL GAS GOVERNOR

Is now in Practical Operation, doing Perfect Automatic Service with Great Precision.

This Governor will do all and more than any other Governor on the Market.

BE SURE TO THOROUGHLY INVESTIGATE THE SUPERIOR MERITS OF THIS COVERNOR BEFORE PURCHASING.

For Simplicity and Reliable Work it has no Equal. Correspondence Solicited.

T. C. HOPPER & CO., - - Manufactory, 2227 Wood Street, Phila, Pa.

MUNICH REGENERATIVE FURNACE

System Drs. Schilling and Bunte.

Greatest Durability! Minimum of Attention!

COMPLETE DISTILLATION IN 3½ HOURS.

Ten to Thirteen Pounds of Coke to Hundredweight of Coal.

NO CLINKER. NO CARBONIC OXIDE IN THE REGENERATIVE FLUES.

Almost Automatic in Action.

The Most Successful Regenerative Furnace in Use.

BARTLETT, HAYWARD & CO

Agents for the United States.

ADAM WEBER'S

New and Improved Regenerative Furnace.

ESPECIALLY ADAPTED FOR USE IN SMALL GAS WORKS.

A Saving of at Least Forty per Cent. over Old Methods.

Cheapness of construction and absence of elaboration are the chief characteristics of this Furnace. It is also applicable in cases where it is not convenient to excavate deeply below the line of the retort house.

Correspondence respectfully solicited. Descriptive Circulars on application.

Manhattan Fire Brick & Enameled Clay Retort Works,

OFFICE, 633 EAST FIFTEENTH STREET, N. Y. CITY.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 42 PINE ST., N. Y.

CONNELLY & CO., LTD.

MANUFACTURERS OF

Steam-Jet Exhausters

Requires one-half the flo r space and one-third less steam than any other Exhauster in the market. More cheaply and easily connected, as outside by-pass valves are dispensed with. It is the only Exhauster manufactured having Compensator and Governor combined; the Compensator with all other Exhausters being a separate and distinct machine. It is simple in construction, easily adjusted, not liable to get out of order, and can be operated by ordinary workmen. Over 1,000 now in use.

No. 177 Broadway, New York.

LUDLOW VALVE MFG. CO.

OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av.

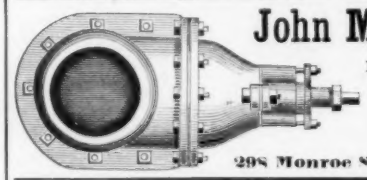
TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ¼ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil.

nd for Circulars.



John McLean

Man'facturer of

GAS VALVES.

298 Monroe Street, N. Y.

O. J. BENHAM, President. C. M. HIGGINS, Secretary. L. H. SEVERANCE, Treasurer.

The Forest City Naptha Co.,

REFINERS OF

Red Crown Brand

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

C. W. HUNT CO.,

No. 111 Broadway, N. Y. City.

MANUFACTURERS OF

Coal Handling Machinery,

AUTOMATIC RAILWAY, HOISTING ELEVATOR, CABLE RAILWAY, STEAM SHOVEL, HOISTING ENGINES, COAL TUBS, COAL & COKE CARS.

Plans and Specifications made for the

Erection of Coal Storage Buildings

Send for a Descriptive Pamphlet.

GAS STOVES. GAS STOVES. GAS STOVES.

THE AMERICAN METER CO.,

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. Nos. 122 & 124 Sutter Street, San Francisco Cal.

No. 810 North Second Street, St. Louis, Mo.

Open Fire Place Heater No. 19.
Fitted with the new Incandescent Gas Fire.

NEW

INCANDESCENT

Gas Fires

AND

OPEN

Fire Place

Heaters.

Open Fire Place Heater No. 17C.
Fitted with Illuminating Burners and Copper Reflectors.

We call attention to Special Apparatus Heated by Gas for Manufacturing Purposes.

GAS FURNACES FOR TINMEN'S USE; FURNACES FOR MELTING SOLDER AND TYPE METAL; APPARATUS FOR BENDING CARRIAGE PANELS, NOW IN SUCCESSFUL OPERATION IN CARRIAGE MANUFACTORIES; WATER HEATERS FOR KITCHEN BOILERS, BATHS, ETC., AND FOR ATTACHING TO HEATING COILS AND PIPES FOR CONSERVATORIES.

THE COMPANY MANUFACTURE

GAS STOVES FOR COOKING AND HEATING PURPOSES

In all Sizes, for Domestic, Restaurant, and Hotel Use.

These Stoves may be seen in operation at our Retail Store, No. 223 Sixth Avenue, N. Y. Call and examine.

SEND FOR CATALOGUE OF TWENTY DIFFERENT STYLES OF HEATING STOVES.

RETORTS AND FIRE BRICK.

J. H. CAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER. T. B. GAUTIER.
C. E. GREGORY. C. E. GAUTIER.

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

Works, LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Successor to WILLIAM GARDNER & SON.
Office, Rooms 19 & 20, Lewis Block, PITTSBURGH, PA. P. O. Box 373.
Fire Clay Goods for Gas Works.
CHAS. H. SPRAGUE & SON, No. 70 KILBY STREET, BOSTON, MASS., Agents for the New England States.

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERSEY.
HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

CHICAGO
Retort & Fire Brick Works,
OFFICE AND FACTORY,
Clark, Forty-Fifth, and La Salle Streets,
CHICAGO, ILL.
GEORGE C. HICKS, PRES. PAUL P. AUSTIN, SEC. & TREAS.
STANDARD
Clay Retorts and Settings.
BLOCKS & TILES
Of every Shape and Size to Order.
Standard Fire Bricks.

NEWBIGGING'S
Gas Manager's Handbook.
Price, $4.80.
EVERY GAS MAN SHOULD HAVE ONE.
Orders may be sent to this Office.

OAKHILL
GAS RETORT & FIRE BRICK
Works.
Proprietors,
PARKER-RUSSELL MINING & MFG. CO.
City Office, 711 Pine Street,
ST. LOUIS, MO.
Our immense establishment is now employed almost entirely in the manufacture of
MATERIALS FOR GAS COMPANIES.
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. Our customers are in almost every State of the Union, to all of whom we refer.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Sup
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.
Connection with the City by Telephone.
Clay Retorts, Blocks & Tiles,
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 86 WATER ST., BOSTON, MASS
Sole Agents the New England States

RETORTS AND FIRE BRICK. GAS LAMPS. EXHAUSTERS. STEAM PUMPS.

EVENS & HOWARD,

916 Market St., St. Louis. Mo.

Works, Howard Station, Mo. Pacific R.R.

Fire Brick, Gas Retorts

AND

RETORT SETTINGS.

Sewer Pipe, 3 to 24 in. diameter.

Glass Pot Clay, Ground Fire Clay, in barrels and in bulk. All kinds of Fire Clay Goods.

Cincinnati Gas Retort & Fire Brick Works.

—*ESTABLISHED* 1872.—

CHAS. TAYLOR,

MANUFACTURER OF

Gas Retorts, Fire Brick, and Tile.

Blast Furnace Linings, Cupola Blocks, Boiler Tiles, Grate Settings, and Stove Linings. Fire Cement, Fire Clay, Fire Sand, and all other Fire Clay Goods.

Branch Works, New Cumberland, W. Va.

GENERAL OFFICE AND WORKS,

Burns St., Cincinnati, Ohio.

Stettiner Chamotte Fabrik Actien Gesellschaft,

Formerly DIDIER,

(Patentees of the Dr. Schilling & Dr. Bunte Regenerative Furnace)

STETTIN, GERMANY.

The attention of all Gas Engineers is called to our Fire-Proof Material, viz.:

CLAY GAS RETORTS

(ENAMELED AND UNENAMELLED),

Blocks, Tiles

AND

EXTRA FIRE BRICK,

Pronounced by the highest authorities as superior to and excelling any other similar manufacture. The component of aluminum contained in our material (up to 45 per cent.) is larger than in any other material heretofore sold in the United States; whilst the uniformity of the goods is assured by the most scrupulous analysis of the clay used.

For any further information and prices please apply to

EMIL LENZ,

2 & 4 Stone St., Room 19, N.Y. City.

PATENTS.

FRANKLIN H. HOUGH,

Solicitor of American & Foreign Patents

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

G. S. COOK, Pres. THOS. DAVENPORT (late Davenport Bros.), Sec. & Treas

BARTLETT Street Lamp Mfg. Co.

MANUFACTURERS OF

Bartlett's Patent

GLOBE LAMPS,

FOR

Streets, Parks, Railroad Stations, Public Buildings, Etc.

LAMP POSTS A SPECIALTY.

Office and Salesroom

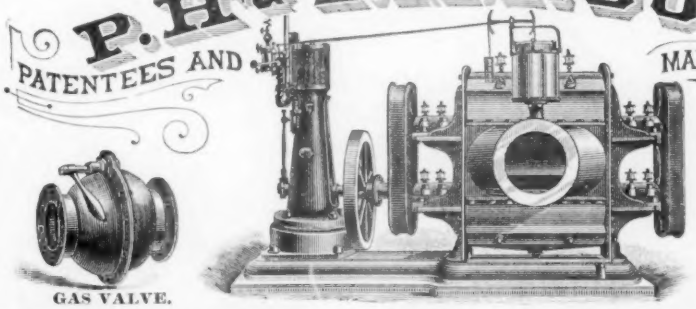
No. 35 Howard Street, N. Y. City.

Gas Companies and others intending to erect lamps and posts will do well to communicate with us.

F. M. ROOTS. S. C. ROOTS D. T. ROOTS.

P. H. & F. M. ROOTS,

PATENTEES AND MANUFACTURERS OF



GAS VALVE. BYE-PASS.

IMPROVED GAS EXHAUSTER,

WITH ENGINE ON SAME BED PLATE, OR WITHOUT.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, Etc., FURNISHED TO ORDER,

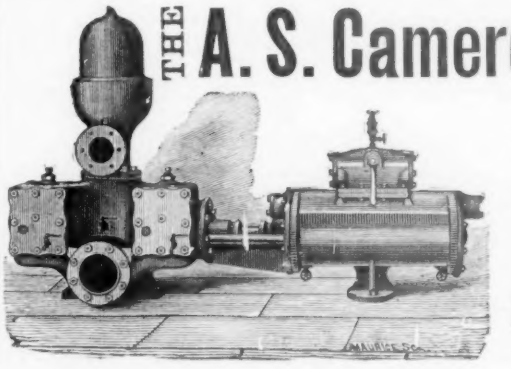
P. H. & F. M. ROOTS, Patentees & Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 22 Cortland St.

COOKE & CO., Selling Agents, 22 Cortland St., N. Y.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.

THE A. S. Cameron Steam Pump,



THE STANDARD OF EXCELLENCE.

Upward of 30,000 in Use.

BEST GAS WORKS PUMP

Ever Introduced.

Adapted to Every Possible Duty.

A. S. Cameron Steam Pump Works.

Foot East 23d St., N. Y.

GAS AND WATER PIPES. GAS AND WATER PIPES. ENGINEERS.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Treas.

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.
NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

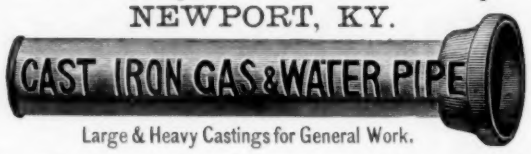
Branches, Bends, Retorts, Etc., Etc. 436-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND **BENCH CASTINGS** A Specialty.



Large & Heavy Castings for General Work.

Branch AND SPECIAL CASTINGS FOR GAS & WATER CO'S.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Pancoast & Rogers.

WROUGHT IRON PIPE,

VALVES AND GATES,

Cast Iron Gas & Water Pipe.

28 Platt and 15 Gold St., New York.

The Management of Small Gas Works.

By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

P. D. WANNER, Chairman. A. H. MELLERT, Sec. & Treas.

MELLERT FOUNDRY & MACHINE CO., Ltd.

Reading, Pa.

Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

CAST IRON

Gas and Water Pipes,

From 2 to 48 nches n Diameter

JOHN FOX,

160 Broadway, N. Y. City.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

95 Liberty St., - New York.

JOS. R. THOMAS, C.E.,

May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.

ADDRESS THIS OFFICE.

WM. FARMER, ENGINEER,

32 Park Place, Room 36, New York.

THE CHEMIST'S ASSISTANT; OR, KINDERGARTEN SYSTEM OF CHEMISTRY.

A system by which the elements and their valences are represented by illustrations and solid bodies.

BOX AND PAMPHLET COMPLETE, $2.50.

WM. HENRY WHITE,

CONSULTING AND CONSTRUCTING

Gas Engineer & Contractor

Estimates, Plans, and Specifications furnished for new wo extensions of existing works.

No. 32 Pine Street, New York City.

Correspondence solicited.

GAS LAMPS. SCRUBBERS AND CONDENSERS.

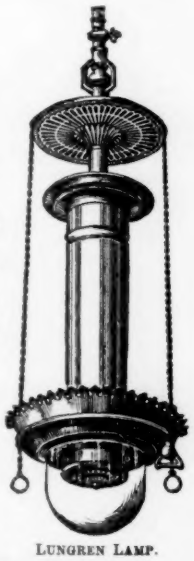
SIEMENS LAMP.

The Siemens and Lungren

REGENERATIVE GAS LAMPS.

A System of Burning Gas whereby its Illuminating Power is Increased fron 300 to 400 per ct. without the Expense, Trouble and Annoyance resulting frow the use of Hydrocarbon Enriching Material.

The Siemens-Lungren Company received the only Silver Medal or Highest Award for Gas Burners at the "Novelties" Exhibition of the Franklin Institute, held at Phila., Oct., '85.



LUNGREN LAMP.

THIRTEEN CANDLE POWER PER CUBIC FOOT OF GAS!

This result is obtained

SIMPLY BY THE SCIENTIFIC APPLICATION OF THE REGENERATIVE PRINCIPLE.

Consequently this largely increased illumination is always maintained without further cost and frequent attention.

THE SIEMENS-LUNGREN COMPANY,

N. E. Cor. 21st. St. and Washington Av., Phila., Pa.

THE "STANDARD" WASHER-SCRUBBER.

The "Standard" Washer-Scrubber has been adopted very generally by Gas Companies in North and South America, Europe, Asia, Australia, and New Zealand.

NO OTHER APPARATUS REMOVES ALL THE AMMONIA FROM THE GAS.

Its dimensions admit of placing it under cover without the great expense incurred in a high building to protect Tower Scrubbers from changes of temperature; thus the "Standard" Washer-Scrubber costs much less than other systems.

J. B. Crockett, Esq., President and Engineer of the San Francisco Gas Light Company, writes, under date of May 22, 1886:

"The 'Standard' Scrubbers have been in constant operation for the past six months, and have given entire satisfaction. We have tried them under many different conditions, and find that, by the use of about two gallons of water per thousand feet of gas, it gives us Liquor of 15 oz. strength. Our coal is from British Columbia, and contains large quantities of Ammonia, and we found it impossible to remove all the Ammonia with one gallon of water; but with two gallons we get good, strong Liquor, and at the same time have no traces of Ammonia at the outlet."

Recent Orders for "Standard" Washer-Scrubbers have been received from

J. P. HARBISON, ESQ., Treas. Hartford City Gas Light Company, and Prest. New England Association of Gas Engineers.
L. N. VAN KEUREN, ESQ., Secretary Bridgeport Gas Light Company - - - - - - - Bridgeport, Conn.
W. H. PEARSON, ESQ., Secretary and General Manager Consumers Gas Light Company, - - - - - Toronto, Can.
E. M. BREESE, ESQ., Engineer and Superintendent Detroit Gas Light Company, - - - - - - Detroit, Mich.

GEO. SHEPARD PAGE, No. 69 WALL STREET, NEW YORK,

SOLE AGENT FOR THE WESTERN HEMISPHERE.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

WORKS: { MILLVILLE, N. J. / FLORENCE, " / CAMDEN, "

R. D. WOOD & CO.,

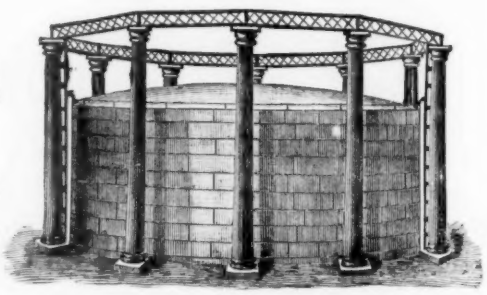
OFFICES: { 400 CHESTNUT ST., / PHILADELPHIA.

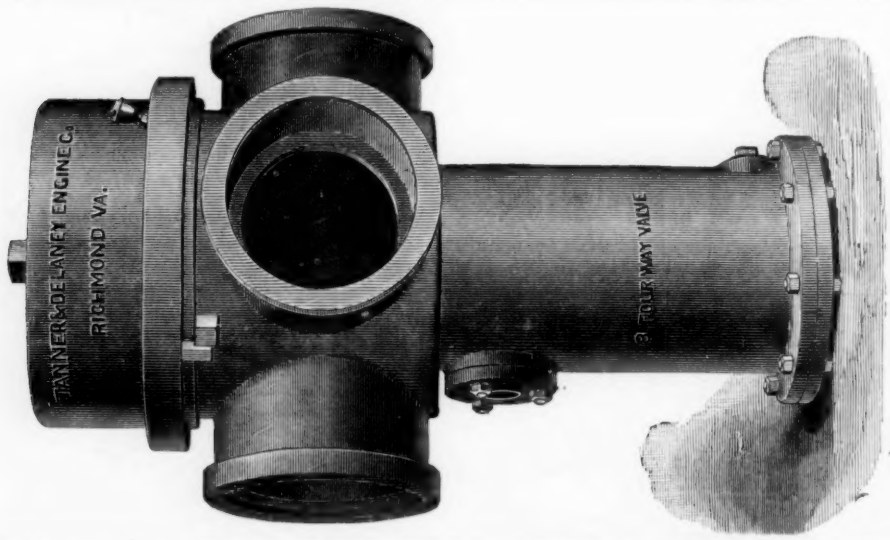
CAST-IRON PIPE 1½ to 72 Inches in Diameter.

Water Machinery and Gas Apparatus. **HEAVY CASTINGS.**

HOLDERS, LAMP POSTS, VALVES, PURIFIERS, CONDENSERS, BENCH WORK, FLOORS AND ROOFS, FLANGED PIPE, FIRE HYDRANTS, METER CASES.

Estimates and Specifications for NEW WORKS or EXTENSIONS or ALTERATIONS of OLD ONES.





W. E. TANNER, Pres. W. R. TRIGG, Vice-Pres. A. DELANEY, Supt.

Tanner & Delaney Engine Co.,

RICHMOND VA.

GAS APPARATUS,

INCLUDING

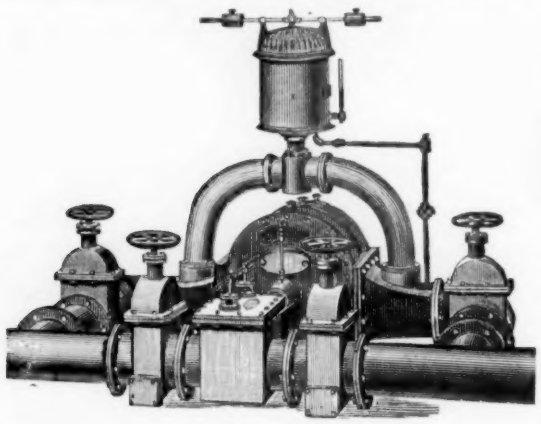
Condensers of Various Styles

SCRUBBERS, PURIFIERS, HOLDERS,

Castings for Retort Houses, Etc.

ALSO STEAM ENGINES AND BOILERS.

Plans, Specifications, and Estimates Furnished.



SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.

SOUTHWARK FOUNDRY AND MACHINE COMPANY,

Successors to MERRICK & SONS,

GAS APPARATUS,

Holders, Purifiers, Washers, Etc., Etc. Boiler and Tank Work. Steam Engines. Hydraulic Machinery. Bessemer Plants, Etc.

Washington Ave. and Fifth Street, Philadelphia, Pa.

MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA PA.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD,
(SUCCESSOR TO HERRING & FLOYD)
Oregon Iron Works,
531 to 543 West 20th St., N. Y.
Practical Builders of Gas Works,
MANUFACTURERS OF
ALL KINDS OF CASTINGS
AND
APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS
wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
all sizes and description.
FLOYD'S PATENT
MALLEABLE RETORT LID.
PATENT
SELF-SEALING RETORT LIDS.
FARMER'S
PATENT BYE-PASS DIP-PIPE.
SABBATON'S PATENT
FURNACE DOOR AND FRAME.
BUTLER'S
COKE SCREENING SHOVELS.

GAS GOVERNORS,
nd everything connected with well regulated Gas Works at ow price, and in complete order.
SELLER'S CEMENT
for stopping leaks in Retorts.
N. B.—STOP VALVES from three to thirty inches—at very low prices.
Plans, Specifications, and Estimates furnished.

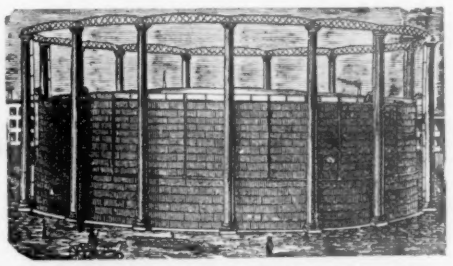
KERR MURRAY MFG. CO.,
MANUFACTURERS OF
Single Lift and Telescopic
GASHOLDERS.

Built, 1884:

Altoona, Pa	Capacity,	160,000	cubic feet.
Pittsburgh, Pa	"	250,000	"
" "	"	220,000	"
Bellaire, Ohio	"	50,000	"
Youngstown, Ohio	"	60,000	"
Canton, "	"	60.000	"
Akron, "	"	80,000	"
Xenia, "	"	10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
Evanston, "	"	50,000	"
Freeport, "	"	35,000	"
Elgin, "	"	60,000	"
Sheboygan Wis	"	20,000	"
Key West Fla	"	10,000	"

Plans and estimates furnished for the erection of new and the rebuilding of old works. Address
Kerr Murray Mfg. Co.,
FORT WAYNE, IND.

CONTINENTAL WORKS.



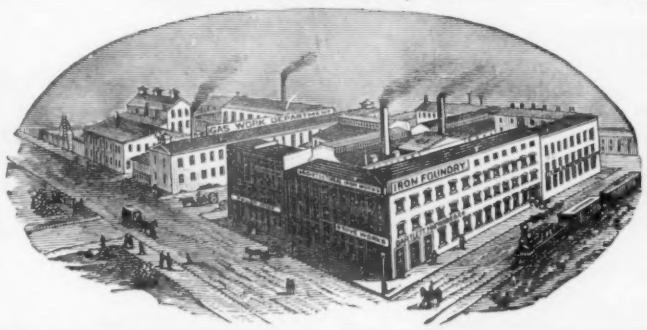
GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,
GREENPOINT, BROOKLYN, N. Y.
ENGINEER AND MANUFACTURER OF
GAS-HOLDERS.
CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,
and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.
STACEY MFG. CO.,
MANUFACTURERS OF
Single and Telescopic Gasholders,
IRON ROOFS, BRIDGES, LAMP POSTS,
Water and Oil Tanks, Coal Elevator Cars,
COKE CRUSHERS, BENCH CASTINGS,
And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works.
Rolling Mill Machinery and Heavy Castings a Specialty.
Foundry: 33, 35, 37 & 39 Mill Street. Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.
Cincinnati, Ohio.

BARTLETT, HAYWARD & CO.,
Office, German & Calvert. **BALTIMORE, MD.** Works, Pratt & Scott.

PURIFIERS. Roofs. Bench Castings.



SCRUBBERS. BOILERS. CONDENSERS

GASHOLDERS.
CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

1842. **DEILY & FOWLER,** 1886.
Laurel Iron Works.
Address, No. 39 Laurel Street, Philadelphia, Pa.
MANUFACTURERS OF
GASHOLDERS,
Single or Telescopic, with Cast or Wrought Iron Guide Frames.
Holders Built Since 1881:

Scranton, Pa. (2d)	Hollidaysburg, Pa.	Jackson, Mich.	Montgomery, Ala.	New Castle, Pa.
West Point, N. Y.	Galveston, Texas (2d.)	Kalamazoo, Mich. (3d.)	Newport, R. I.	Long Island City, N. Y.
Fitchburgh, Mass.	Marlboro, Mass.	Glen Island, N. Y.	Portland, Oregon.	Macon, Ga.
New London, Conn.	Denver, Col.	Warren, Ohio.	Allegheny, Pa. (2d.)	York, Pa.
Derby, Conn.	Chicago, Ill. (West Side).	Bath, N. Y.	Atlanta, Ga. (2d.)	Chester, Pa.
Bridgeport, Conn.	Pittsburgh, Pa. (S. Side).	Lynn, Mass.	N.Y.City (Central Gas Co)	Hazleton, Pa. 2d.)
Allegheny, Pa. (1st.)	Pawtucket, R. I.	New Bedford, Mass.	Lynchburg, Va. (2d.)	Novelties Exhib., Phila
St. Hyacinth, Can.	Brookline, Mass.	Waterbury, Conn.	Saylesville, R. I.	Staten Island, N. Y.
Norwalk, O.	Sherbrooke, Can.	Desoronto, Can.	Rondout, N. Y.	Saugerties, N. Y.
Brattleboro, V	Burlington, N. J. (2d.)	Hoosic Falls, N. Y. (2d.)	Atlantic City, N. J.	Clinton, Mass. (Lan. Mills
Waltham, Mass. (2d.)	Bridgeton, N. J.	Bethlenem, Pa.	Augusta, Ga.	Chattanooga, Tenn.
West Chester, Pa.	Bay City, Mich.	Atlanta, Ga. (1st.)	Waltham, Mass. (2)	Galveston, Texas. (3d.
Baltimore, Md.	Erie, Pa.	Savannah, Ga.	Mahanoy City, Pa.	Omaha, Neb.

GAS COALS. EXHAUSTERS. PROCESSES.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

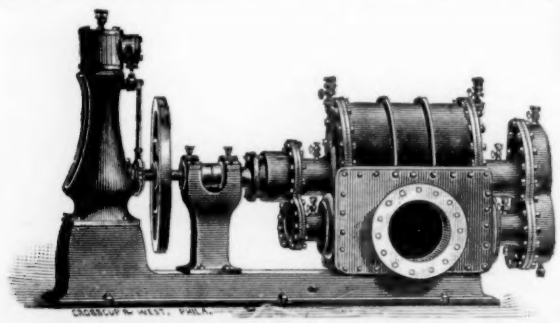
General Sales Agents for

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.* (See Map on p. 87 of this Journal, Feb. 16, 1885.)

P. O. Box 3695, New York. **PERKINS & CO., 228 and 229 N. Y. Produce Exchange** BEAVER STREET ENTRANCE.



The Wilbraham Gas Exhauster,

"BAKER SYSTEM,"

WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.

NATIONAL GAS LIGHT AND FUEL COMPANY,

Sole Owners and Licensees of the Springer Patent Cupola and Process for the U. S..

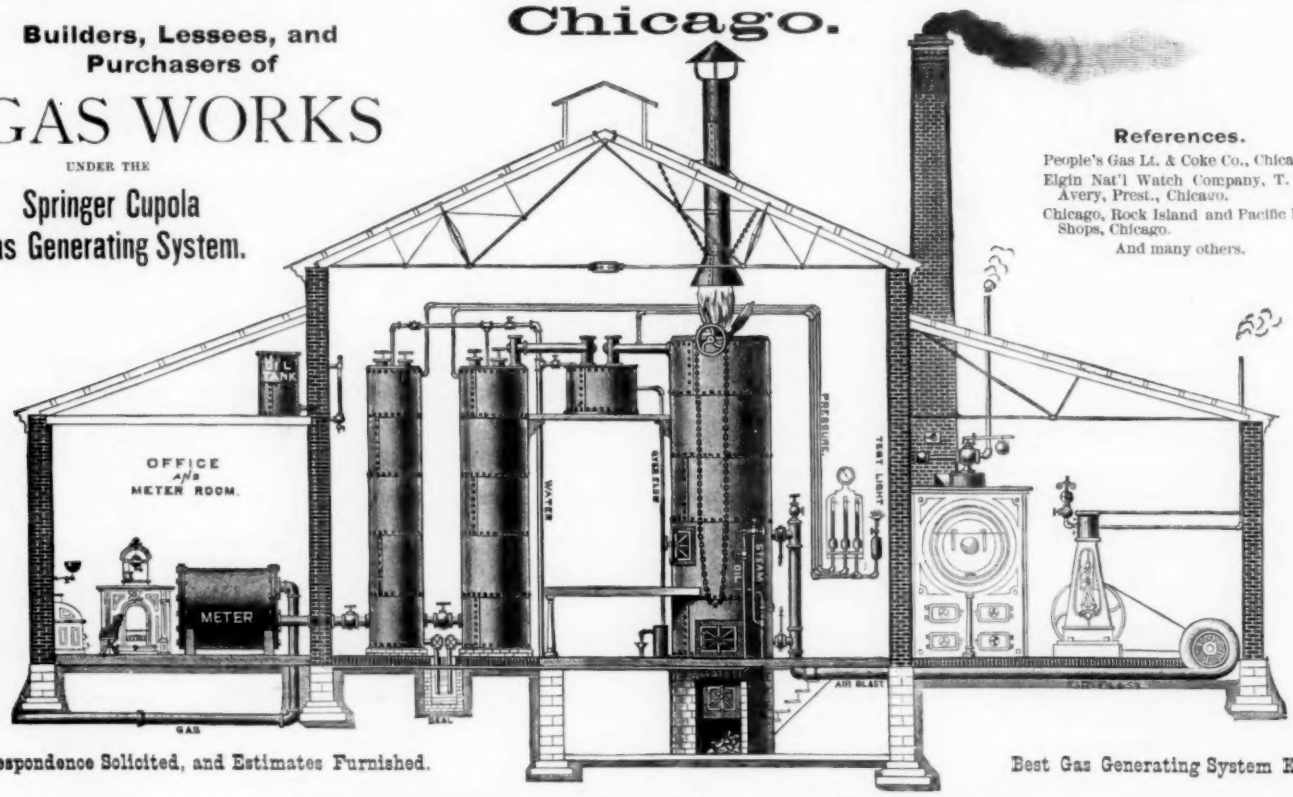
Chicago.

Builders, Lessees, and Purchasers of

GAS WORKS

UNDER THE

Springer Cupola Gas Generating System.



References.

People's Gas Lt. & Coke Co., Chicago.
Elgin Nat'l Watch Company, T. M. Avery, Prest., Chicago.
Chicago, Rock Island and Pacific Ry. Shops, Chicago.
And many others.

Correspondence Solicited, and Estimates Furnished.

Best Gas Generating System Known.

Orders from Cities, Towns, and Public Institutions Promptly Executed. Address

NATIONAL GAS LIGHT AND FUEL COMPANY, - - - - No. 218 La Salle Street, Chicago, Ill.

STEAM ENGINES. GAS COALS. GAS COALS.

Newburgh Orrel Coal Co.,

MINERS AND SHIPPERS OF

Newburgh Orrel, Tyrconnell and Palatine Gas Coals.

ALSO SHIPPERS OF FOUNDRY COKE.

Mines Situated at

Newburgh, Flemington & Fairmont, W.Va.

HOME OFFICE,

25 S. Gay St., Baltimore.

CHARLES MACKALL,

MANAGER.

CHAS. W. HAYS, Agent in New York,

Room 92, WASHINGTON BUILDING, **No. 1 Broadway.**

Shipping wharves at Locust Point. References furnished when required. Special attention given to chartering vessels.

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

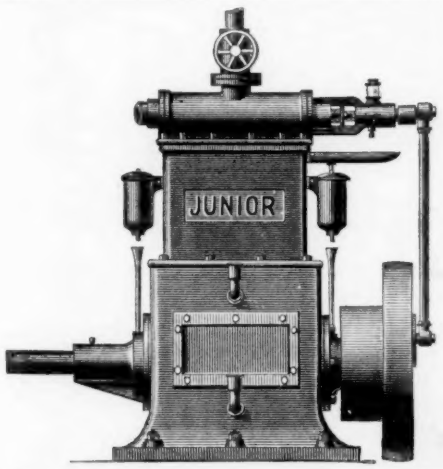
To Gas Light Companies and Manufacturers of Fire Clay Goods Throughout the Country.

ROUSSEL & HICKS, 71 Broadway, N. Y. } *AGENTS.* { BANGS & HORTON, 16 Kilby St., Boston.

Mines in Harrison Co., West Va. Wharves, Locust Point, Balt.

Company's Office, 15 German St., Baltimore, Md.

Among the consumers of Despard Coal we name: Manhattan Gas Light Co., N. Y.; Metropolitan Gas Light Co., N. Y.; Jersey City, (N. J.) Gas Light Co.; Washington (D. C.) Gas Light Co.; Portland (Maine) Gas Light Co. Reference to them is requested.



THE WESTINGHOUSE MACHINE COMPANY,

IN ADDITION TO ANNOUNCING A GENERAL

REDUCTION IN PRICE

OF THE

Westinghouse Automatic Engine,

NOW PLACE UPON THE MARKET THE

"Junior" Automatic Engine.

This is a Special Design for the legitimate Low-Priced Trade, and is sold

AT A PRICE THAT CANNOT BE MET

by the Cheapest Throttling Engines. Sizes, 15, 25, and 35 H.P. only. Automatic, Close Governing, Economical, Single Acting Internal Lubrication, Forged Steel Shaft and Rods, Well Built, and Serviceable. *Nothing like it ever offered.*

ADDRESS ALL CORRESPONDENCE TO

WESTINGHOUSE, CHURCH, KERR & CO.,

17 Cortlandt St., N. Y., and 98 4th Av., Pittsburgh.

Fairbanks, Morse & Co ..... Chicago, Ill.
Fairbanks & Co ..... St. Louis, Mo.
Parke & Lacy ..... San Francisco, Cal.
Parke, Lacy & Co ..... Salt Lake, Utah.
D. A. Tompkins & Co ..... Charlotte, N. C.
Robert Middleton ..... Mobile, Ala.
H. Dudley Coleman ..... New Orleans, La.
Keating Implement & Machine Co., Dallas, Texas

THE

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, Sales Agent. | **OFFICE, 150 BROADWAY, N Y.**

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

A. M. SCOTT, PRESIDENT. A. DEMPSTER, C.E., SECRETARY. W. K. GILLESPIE, TREASURER.

MONONGAHELA AND PETERS CREEK GAS COAL CO.,

PRODUCERS OF

Coal Bluff Gas Coal.

MINES LOCATED ON THE MONONGAHELA DIVISION OF THE PENNSYLVANIA RR., IN THE CENTRAL PORTION OF THE PITTSBURGH COAL FIELD.

Points of Shipment—Buffalo, Cleveland, Erie, Chicago, New Orleans.

Since the introduction of Coal Bluff Gas Coal it has taken rank among the few first-class Gas Coals, and acknowledges no superior in gas-giving qualities, ease of working, quality of coke, and freedom from impurities.

General Eastern Agents, ANDREW LANGDON & CO., Buffalo, N. Y.
General Western Agents, ANDREW LANGDON & CO., Chicago, Ill.
Milwaukee Agents, F. R. BUELL & CO., - - - Milwaukee, Wis.

General Office, 43 Sixth Ave., Pittsburgh, Pa.

GAS METERS. GAS METERS. GAS METERS.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

Twelfth and Brown Streets, Philadelphia, Pa. No. 49 Dey Street, N. Y. City, and No. 75 North Clinton Street, Chicago, Ill.

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

Maryland Meter and Manufacturing Co.,

DICKEY, TANSLEY & CO.,

Established 1866.

Nos. 22 and 24 Saratoga Street, Baltimore, Md.
No. 46 La Salle St., Chicago, Ill.

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, GLAZED METERS, TEST METERS, METER PROVERS, PRESSURE AND VACUUM REGISTERS, GOVERNORS, INDICATORS, SERVICE AND METER COCKS, AND METER CONNECTIONS.

Dry Gas Meter.

With 39 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

SCIENTIFIC BOOKS.

We are prepared to furnish to Gas Managers, and others interested in the topics treated of, the following books, at prices named:

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

TECHNICAL GAS ANALYSIS. $2.80.

GAS MANAGER'S HANDBOOK, by THOS. NEWBIGGING. $4.80.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 30 cents.

PURIFICATION OF COAL GAS, by R. P. SPICE. 8vo. $3.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDREDGE. 40 cents.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE GAS MANAGER IN THE LABORATORY, by a Practical Student. 8vo., Cloth. $1.50.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. $8.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS AS A SOURCE OF LIGHT, HEAT, AND POWER, by C. J. R. HUMPHREYS. 10 cents.

GAS COMPANIES DIRECTORY. $10.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

The above will be forwarded by express, upon receipt of price. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check draft, or post office money order.

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS METERS. GAS METERS. GAS METERS.

T. C. HOPPER, Pres. G. J. McGOURKEY, Vice-Pres. (New York). WM. N. MILSTED, Gen. Supt. & Treas. (New York). WM. H. DOWN Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES,
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco

HELME & McILHENNY,

(Successors to Harris & Brother. Established 1848.)

GAS METER MANUFACTURERS,

CONTINUE AS HERETOFORE AT THE OLD ESTABLISHMENT,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

To Manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers,

GOVERNORS, INDICATORS, PHOTOMETERS, & ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

From our long practical experience of the business, and from our personal supervision of all work, we car guarantee all orders to be executed promptly, and in every respect satisfactorily.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. S. L. JONES, Sec. S. V. MERRICK, Supt.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 142 Chambers St., New York.
76 Dearborn St., Chicago, Ill.

WALDO BROS., Agents, 88 Water St., Boston.

MANUFACTURERS OF THE "SUN DIAL" GAS STOVES, FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Brav's Patent Gas Burners and Lanterns.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

G. B. EDWARDS, Mang'r, New York.
E. H. B. TWINING, Mang'r, Chicago.
A. B. STANNARD, Agent.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (29 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

KING'S TREATISE ON COAL GAS.

The most complete work on Coal Gas ever published. Three vols., bound, $30

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS ENGINES. GAS ENGINES. GAS ENGINES.

THE "OTTO" GAS ENGINE.

Guaranteed to Consume 25 to 75 Per Cent. LESS GAS than ANY OTHER GAS ENGINE PER BRAKE HORSE POWER.

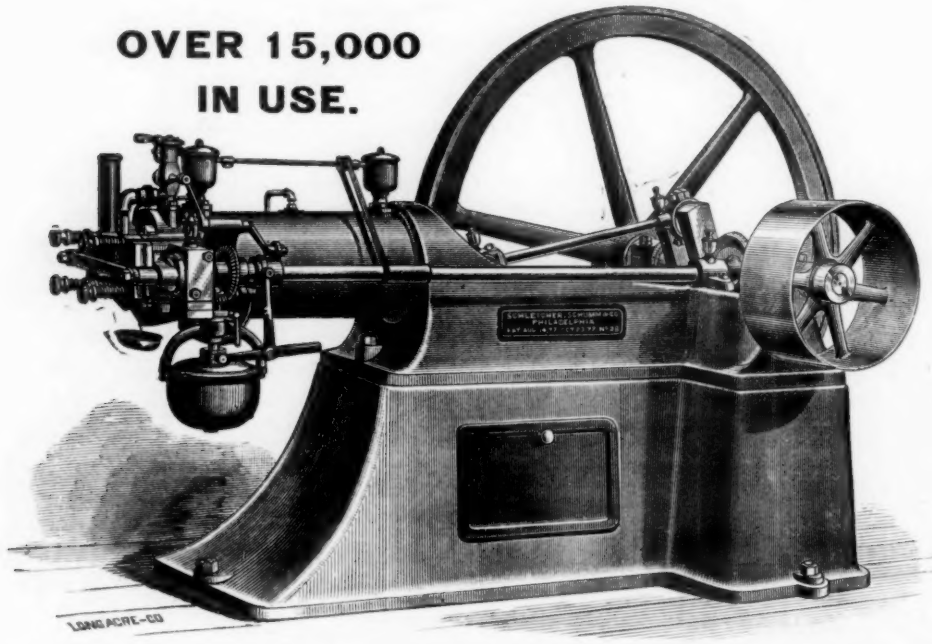
TWIN ENGINES Impulse every revolution.
THE STEADIEST RUNNING GAS ENGINE YET MADE.

ENGINES AND PUMPS COMBINED,

For Hydraulic Elevators, Town Water Supply, or Railway Service.

Special Engines for Electric Light Work.

OVER 15,000 IN USE.



The Otto Gas Engine is now consuming, at a moderate computation, 2000 millions cubic feet of gas per year, nearly all of which is furnished during day time only.

THE ONLY HIGHEST AWARD, ONLY GOLD MEDAL,

AT ELECTRICAL EXHIBITION, PARIS, 1881.

MADE IN SIZES FROM 1 TO 25 HP. INDICATED.

FOR PARTICULARS, PRICES, ETC., APPLY TO

SCHLEICHER, SCHUMM & CO.,

Works:
N. E. Cor. 33d & Walnut Sts., Phila., Pa.

Branch Office:
130 Washington Street, Chicago, Ill.